Thin Paper Copy for Circulation Abroad.

No. 22. Vol. 6.

SIXPENCE.
(Registered as a Newspaper.)

FRIDAY,
FEBRUARY 10, 1905.

PAGE'S WEEKLY

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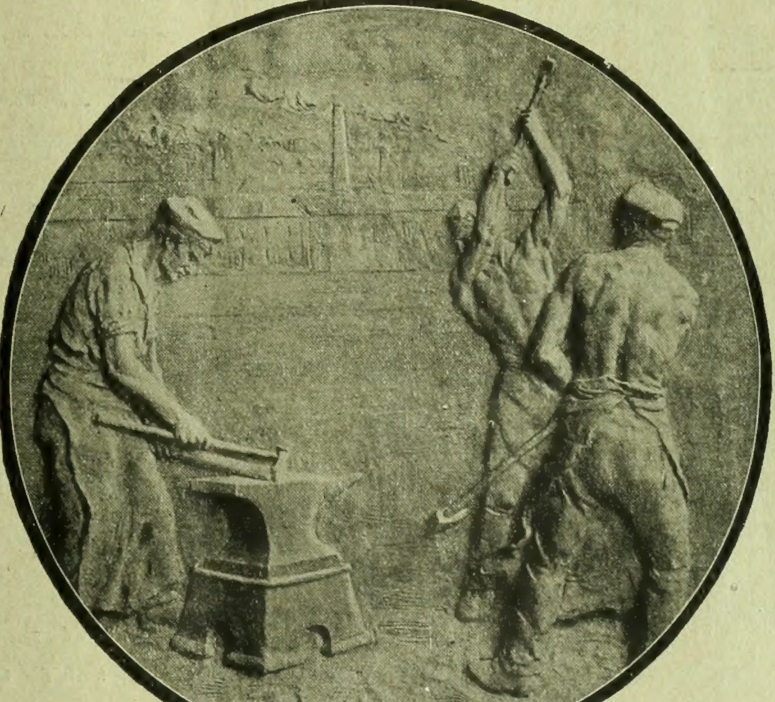

ENGINEERING · ELECTRICITY SHIPBUILDING · MINING IRON & STEEL INDUSTRIES

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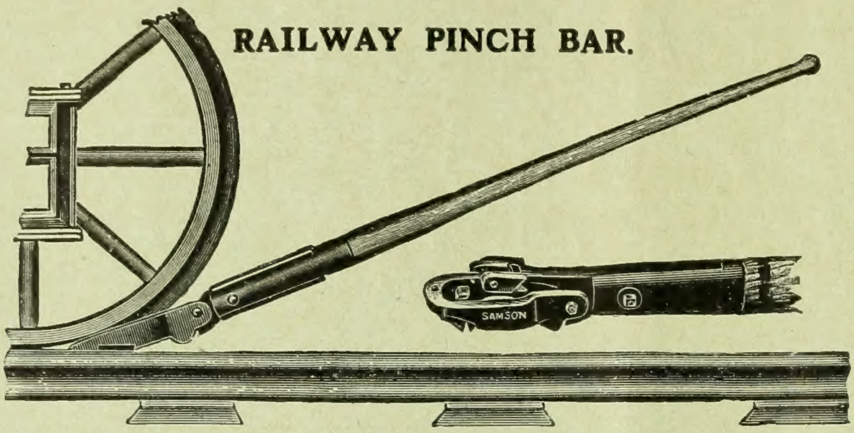

A Few of the Users of the "Samson" Pinch Bars :—

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Is used as a great labour-saving tool where wagons or locomotives require moving short distances.

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SPECIMEN BAR SENT ON SEVEN DAYS' FREE TRIAL CARRIAGE PAID BOTH WAYS.

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PAGE'S WEEKLY Miscellaneous

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Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

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Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

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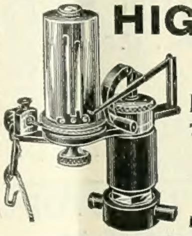
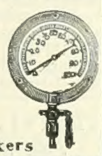
And 14, St. Ann's Square, Manchester.





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ENGINE COUNTERS.
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On Admiralty List.
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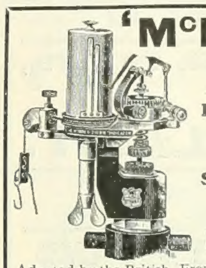

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In Two types: External and Enclosed Pressure Springs.
Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

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45, BOTHWELL ST., GLASGOW.

Adopted by the British, French, and Japanese Admiralties.

BABCOCK & WILCOX, Ltd.

PATENT WATER-TUBE BOILERS.

These Boilers are in use throughout the world to the extent of 4,700,000 h.p., generating steam for all purposes, and fired with all kinds of fuel.

See our Advertisement appearing February 17th, page 45.

HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
WORKS—Renfrew, SCOTLAND.

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APPLY FOR CATALOGUE.

FALMOUTH ROAD, LONDON, S.E.

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Water stored where most convenient under pressure and automatically distributed.

For Town and Village Supplies, Suburban Establishments, High Buildings, Factory Sprinklers, etc.

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Licensee, Sole Agent, and Manufacturer for the United Kingdom and Colonies.

HARTLEY & SUGDEN, LIMITED, HALIFAX. TRADE MARK H & S Hx

Heating Apparatus

BOILERS

Wrot Welded Iron and Cast Iron Sectional

VERTICAL STEAM BOILERS

Apply for Catalogue.

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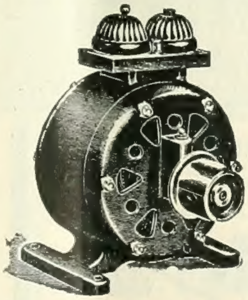

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Alternating Current Motors,

IN SMALL SIZES.

THE CRYPTO ELECTRICAL CO.,
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BERMONDSEY.

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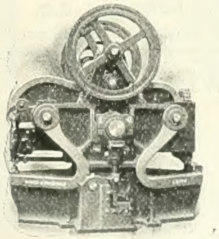

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STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.

DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.

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Price List on application to—

BOOKER & SULLIVAN,
67 and 69, Chancery Lane, LONDON, W.C.
Telephone: 9252 Central.

PAGE'S WEEKLY Miscellaneous

Bogie Locomotives for Short Curves. A large number of these Engines have been built to NARROW and to NORMAL GAUGE.—For full particulars, and for Licences, &c., address the HAGAN'S LOCOMOTIVE WORKS, ERFURT, GERMANY.

Melville and Macalpine, Consulting Engineers
and NAVAL ARCHITECTS,
615, WALNUT STREET, PHILADELPHIA, PA., U.S.A.

Rear-Admiral GEORGE W. MELVILLE, Ex-Engineer-in-Chief of the United States Navy, and JOHN H. MACALPINE, having a very extensive acquaintance in the best engineering circles in the United States, Britain, and the Continent of Europe, especially SOLICIT INTERNATIONAL BUSINESS.

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COVENTRY, ENG.
Speciality—
FORGING PLANT.
See our Advertisement appearing February 17th.
SEND FOR LATEST CATALOGUE.

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Iron & Steel Bars, Plates, Sheets, Girders, Channels, Angles, Rails, Blooms, Billets, & Slabs.
Write for Section Lists and Prices.
Telegrams: "LEGATION, LEEDS."

W. R. RENSHAW & Co., Ltd.,
Manufacturers of RAILWAY CARRIAGES, WAGONS, WHEELS & AXLES, and all classes of RAILWAY IRONWORK
RAILWAY WAGONS FOR HIRE.
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London Office: 46, KING WILLIAM STREET, E.C.

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Makers and Erectors of all Classes of
CONVEYING PLANTS, COAL HANDLING PLANTS, AERIAL ROPEWAYS, &c., &c.

TRANSPORTERS.
See our Advertisement appearing February 17th.
TEMPERLEY TRANSPORTER CO.,
72, Bishopsgate Street Within, LONDON, E.C.
Telephone: 365 London Wall. Telegrams: "Transumo."

Twist Drills,
Taps,
Milling Cutters,
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Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.
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WEST PASCAGOULA CREOSOTING WORKS,
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Situated on Pascagoula Bay and on the line of the Louisville and Nashville Railroad. These works have been in operation for more than twenty-six years. ORDERS for Creosoted Piles, Telegraph Poles, Cross Arms, Electric Conduits, Paving Blocks, Sawed Tiles, and Timber PROMPTLY EXECUTED. New cylinders, 115 ft. long. Capacity, one million feet per month. A.B.C. Code used. Cable address: Pierre, West Pascagoula, Miss.—Address, JNO. B. LINDSEY, Superintendent.

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FOR RAISING SEWAGE, SLUDGE, WATER, &c.
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MANUFACTURERS OF . . .
Rolled Steel Joists, Channels, etc.
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Speciality: **TRAMRAILS.**

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CAST-IRON
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Write for Prices and Particulars
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NEW "STANDARD" MACHINES.
They will interest you.
Dynamos "P.D.M." Motors
BEST MATERIAL, WORKMANSHIP AND DESIGN.
PHŒNIX DYNAMO MFG. CO., Ltd.,
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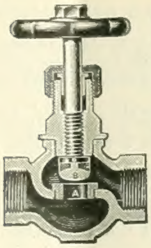
PAGE'S WEEKLY Miscellaneous



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With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

Try Them ! Sent on Approval.

☞ *Write for particulars of these and other Specialities for High Pressure Steam.*

JOSEPH SHAW, B Dept., Albert Works, **HUDDERSFIELD.**

Refuse Destructors.

Write for particulars to:—

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4, Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.

HIGH-CLASS NON-CORROSIVE
LUBRICATING OILS AND SOLIDIFIED LUBRICANTS.
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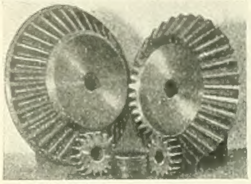

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A SPECIALITY.
Also all kinds of Metal Gearing
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RECORDERS.

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Telegrams:— "EBONESTOS LONDON"
B. WEAVER & Co
Patentees & Manufacturers of
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Suitable for Bushings Nipples, Switch Handles & other small Insulating Fittings.
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NEW MACHINE TOOLS
IN STOCK FOR IMMEDIATE DELIVERY.

THOS. W. WARD, LIMITED,
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SHEFFIELD.
Send for Catalogue (post free).

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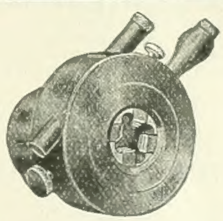
GRAB DREDGERS.
Rose, Downs & Thompson, LTD.,
Old Foundry, HULL,
and
12, Mark Lane, LONDON, E.C.
OIL REFINERIES.
WATER SOFTENING PLANT.



HARTNESS
AUTOMATIC OPENING DIE
The most satisfactory means yet devised for the production of screw threads.
JONES & LAMSON MACHINE CO.,
JUBILEE BUILDINGS,
97, Queen Victoria Street, LONDON.

PAGE'S WEEKLY Contracts

CONTRACTS.

BOROUGH OF NEWCASTLE-UNDER-LYME.

SEWAGE DISPOSAL WORKS.

TENDERS are invited for the MANUFACTURE, DELIVERY, and ERECTION of THREE SETS of GAS ENGINES and CENTRIFUGAL PUMPS.

Specifications and Drawings may be obtained at the offices of the Engineers, Messrs. WILLCOX AND RAIKES, Union Chambers, 63, Temple Row, Birmingham, on or after Wednesday, February 1st, 1905, on payment of a deposit of Two Guineas, which will be refunded (after the Contract has been decided upon) to those persons who have sent in a *bonâ fide* Tender, and who have refunded the whole of the documents entrusted to them.

Sealed Tenders, upon the forms supplied, endorsed "Sewage Pumping Machinery," to be delivered at my office not later than 12 o'clock noon on Wednesday, February 22nd, 1905.

Contracts will only be given to firms paying the standard rate of wages of their districts.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
JOSEPH GRIFFITH,
Town Clerk.

Town Hall, Newcastle-under-Lyme, Staffordshire.

TENDERS FOR PERMANENT-WAY MATERIALS.

The CROWN AGENTS for the COLONIES, acting on behalf of the Government of Lagos, invite TENDERS from Manufacturers for the SUPPLY of—

STEEL RAILS, FISHPLATES, and STEEL SLEEPERS for 30 miles of Single Track. Alternative offers are required for (a) 50 lb. per yard section, and (b) 55 lb. per yard British Standard Section.

Tender Forms, Specifications, and Conditions of Contract can be obtained on application to the Crown Agents, at whose office the Drawings will be on view between the hours of Ten a.m. and Four p.m. (Saturdays Ten to One).

A charge of £1 will be made for a set of Specifications, which will be returned upon application on receipt of a *bonâ fide* Tender.

Tenders to be delivered in sealed envelope, addressed to the CROWN AGENTS for the COLONIES, Whitehall Gardens, S.W., and endorsed "Tenders for Permanent-Way Material—Lagos Railway," not later than Noon on Tuesday, February 14th, 1905.

The Crown Agents do not bind themselves to accept the lowest or any Tender.

METROPOLITAN BOROUGH OF FULHAM.

ELECTRICITY DEPARTMENT.

The Establishment Committee are prepared to receive TENDERS for the Supply and Erection of—

A. CONDENSING PLANT.
B. BOILERS.
C. ECONOMISERS.
D. STOKERS.

Specification, Drawings, and Forms of Tender may be obtained from the Borough Electrical and Consulting Engineer, Mr. ARTHUR J. FULLER, after the 8th inst., on payment of a deposit of One Guinea, which will be returned on receipt of a *bonâ fide* Tender.

Tenderers are requested to state which section they wish to tender for.

Tenders, made out on Form supplied, addressed to the Town Clerk, Town Hall, Fulham, and endorsed "Tender for Contracts 'L,'" to be delivered at the Town Hall not later than Twelve noon on Wednesday, the 22nd inst., 1905.

The lowest or any Tender not necessarily accepted.

R. M. PRESCOTT, Town Clerk.

Town Hall, Fulham, February 1st, 1905.

MANCHESTER CORPORATION TRAMWAYS.

The Tramways Committee of the Manchester Corporation are prepared to receive TENDERS for the SUPPLY and ERECTION of a MAIN SWITCHBOARD, AUXILIARY DISTRIBUTION BOARDS, &c., for their Car Repairing Works.

Specifications, &c., may be obtained on application to Mr. J. M. McELROY, General Manager, Tramways Department, 55, Piccadilly, Manchester, on deposit of £1 1s., which will not be returned except on receipt of a *bonâ fide* Tender.

Tenders are to be addressed to the Chairman of the Tramways Committee, 55, Piccadilly, Manchester, endorsed "Tender for Switchboard," and must be received not later than 10 a.m. on Tuesday, February 14th, 1905.

The Committee do not bind themselves to accept the lowest or any Tender.

WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
February 1st, 1905.

COUNTY BOROUGH OF BURY.

ELECTRICITY WORKS EXTENSION.

The Electricity Committee is prepared to receive TENDERS for the Supply and Erection of the following Plant:—

ONE 500kw DIRECT-CURRENT HIGH-SPEED GENERATING SET.

Copy of Specification and Form of Tender may be obtained from Mr. S. J. WATSON, M.I.E.E., Engineer and Manager, Electricity Works, Bury, on payment of a deposit of Two Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders, endorsed "Tender for Generating Plant," and addressed to the undersigned, must be delivered at the Municipal Offices, Bank Street, Bury, not later than noon on Tuesday, February 14th, 1905.

Municipal Offices, Bury, JOHN HASLAM,
January 23rd, 1905. Town Clerk.

BURY AND DISTRICT WATERWORKS.

TO CONTRACTORS.

PIPE LINE FROM GIN HALL RESERVOIR TO WHITEFIELD, CONTRACT No. 2.

The BURY and DISTRICT JOINT WATER BOARD invite TENDERS for CUTTING and REFILLING TRACK and LAYING and JOINTING 10,500 lineal yards of 12-in. diameter CAST-IRON from Gin Hall Reservoir, near Bury, to Whitefield, and other relative works.

Plans may be seen and copies of the Specification and Bill of Quantities and Form of Tender obtained at the Bury Office of the Engineer to the Board, Mr. J. CARTWIGHT, Civil Engineer, Peel Chambers, Bury, on and after the 20th instant, upon payment of £1. This sum of deposit will, after the Board shall have come to a decision upon the Tenders, but not before, be returned to the Tenderers, provided they shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same, and shall have returned all documents furnished to them for the purpose of making up their Tender.

Tenders, enclosed in the official envelopes provided, must be delivered at the Office of the Subscriber not later than Saturday, the 18th February next.

JOHN HASLAM,
Bank Street, Bury, Clerk to the Board.
January 16th, 1905.

PLYMOUTH CORPORATION WATERWORKS.

TENDERS are invited for the SUPPLY of the following GOODS and MATERIALS for a period of One Year:—

FIRE HYDRANTS.
LEAD PIPE and PIG LEAD.
STOPCOCKS, FERRULES, &c.
CAST-IRON WORK.
SLUICE VALVES.

Particulars and Forms of Tender can be obtained at this office on and after Tuesday, January 31st, 1905.

The lowest or any Tender will not necessarily be accepted.

Tenders, enclosed in envelopes provided, to be delivered at this office by Twelve o'clock noon on Wednesday, February 15th, 1905.

FRANK HOWARTH, Assoc.M.Inst.C.E.,
Water Engineer.

Municipal Offices, Plymouth, January 24th, 1905.

GLEMSFORD WATER SUPPLY.—The Glemsford Urban District Council are prepared to receive TENDERS for the following:—

CONTRACT No. 2.—CAST IRON PIPES and SPECIALS: $2\frac{3}{4}$ miles of 5, 4, and 3in. Socket Pipes, Bends, Branches, &c.

CONTRACT No. 3.—LAYING and JOINTING about $2\frac{3}{4}$ miles of CAST IRON PIPES, FIXING SLUICE VALVES, HYDRANTS, &c.

CONTRACT No. 4.—ERECTION of BRICK WATER TOWER about 19ft. diameter and 45ft. high; also a PUMPING STATION.

CONTRACT No. 5.—One 13 B.H.P. OIL ENGINE and ONE VERTICAL THREE-THROW RAM PUMP with all accessories.

CONTRACT No. 6.—STEEL TANK, 20ft. 3in. diameter by 15ft. 6in. deep, erected on Water Tower.

Plans may be seen and specifications and quantities obtained from the Engineer, Mr. J. T. EAYRS, M.Inst.C.E., Clarence Chambers, 39, Corporation Street, Birmingham, on and after the 11th inst., on payment of a deposit of Two Guineas in respect of each contract, which will be repaid only on receipt of a *bonâ fide* Tender, and the return of all the documents fully priced in.

Plans in connection with Contracts 3 and 4 may also be inspected at the office of the Surveyor to the District Council of Glemsford.

Tenders to be sent in addressed to me on or before the 1st day of March, 1905, endorsed "Water Supply Contract No. —" as the case may be.

The Council do not bind themselves to accept the lowest or any Tender.

THOS. BATES, Clerk to the Urban District Council.

Glemsford, Suffolk, February 1st, 1905.

PAGE'S WEEKLY Contracts

METROPOLITAN BOROUGH of STOKE NEWINGTON.

ELECTRIC LIGHTING.

The Council of the Metropolitan Borough of Stoke Newington are prepared to receive **TENDERS** for the Supply, Delivery, and Erection of the following Sub-station Plant and Mains :—

Section 1.—TRANSFORMERS, THREE-PHASE MOTOR-GENERATORS, BOOSTERS, &c.

Section 2.—Extra H.T. and three-wire L.T. SWITCHBOARDS.

Section 3.—STORAGE BATTERY.

Section 4.—L.T. DISTRIBUTION MAINS.

Contractors may tender for one or more of the above sections, but not for part of a section.

Specifications and plans may be seen at the Offices of the Engineers, Messrs. TALBOT AND STEVENSON, 26, Victoria Street, London, S.W., but copies of these with general conditions and form of Tender may be obtained only at the offices of W. F. LOVEDAY, Esq., Borough Surveyor, Town Hall, Milton Road, Stoke Newington, N., on or after the 6th day of February, on deposit of cheque value One Guinea for each section, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders endorsed "Section———, Electric Lighting," are to be addressed to the Electric Lighting Committee, and must be delivered at the Town Hall, Milton Road, Stoke Newington, N., at or before 4 o'clock p.m. on Wednesday, the 8th day of March, 1905.

By order,
GEORGE WEBB, Town Clerk.

EAST ARGENTINE RAILWAY COMPANY, LIMITED.

The Directors are prepared to receive **TENDERS** for the MANUFACTURE and DELIVERY f.o.b. of THREE LOCOMOTIVE ENGINES and TENDERS.

Specifications and Forms of Tender may be obtained at this office on payment of the fee of One Guinea, which payment will not be returned.

Tenders must be delivered in sealed envelopes, addressed to the Chairman and Directors of the Company, marked "Tenders for Locomotives," not later than 12 noon on Friday, February 17th, 1905.

The Directors do not bind themselves to accept the lowest or any Tender.

R. J. FENNESSY,
Secretary.

Offices of the Company,
Winchester House, 50, Old Broad Street, London, E.C.,
February 2nd, 1905.

BOMBAY, BARODA, AND CENTRAL INDIA RAILWAY COMPANY.

The Directors are prepared to receive up to noon on Tuesday, the 14th February, **TENDERS** for the SUPPLY of the following STORES, viz. :—

Class A.

1. Buffers, Screw Couplings, and Safety Chains.
2. Eye Bolts and Strand Wire for Fencing.
3. Paints, &c.
4. Rolled Material for "F" Class Wagons.
5. Wheels and Axles.

Class B.

1. Beater Picks and Shovels.
2. Eye Bolts and Strand Wire for Fencing.
3. Laminated Bearing Springs.
4. Pillars, Posts, &c., for Fencing.
5. Spiral and Volute Springs.

Tenders must be made on forms, copies of which, with specifications, can be obtained at these offices on payment as follows : For Class A, 21s. each, and for Class B, 10s. 6d. each, which will not be returned.

The Directors do not bind themselves to accept the lowest or any Tender.

Offices : Gloucester House,
Bishopsgate Street Without, London, E.C.,
January 30th, 1905.

T. W. WOOD,
Secretary.

MERTHYR TYDFIL WATERWORKS.

HIGH-LEVEL AQUEDUCT.

The Urban District Council of Merthyr Tydfil are prepared to receive **TENDERS** from Pipefounders, Valve Makers, and others for the SUPPLY and DELIVERY of between 5,700 and 6,000 Tons of CAST IRON PIPES, of diameters ranging from 20 in. to 6 in., and for VALVES and other articles.

Drawings may be seen, and specifications and quantities obtained, on and after Monday, January 30th, 1905, on application at the office of the Engineer, Mr. GEORGE F. DEACON, 16, Great George Street, Westminster, S.W., or at my office at the Town Hall, Merthyr Tydfil, on deposit of a cheque for £2 2s., returnable on receipt of a *bonâ fide* Tender.

Sealed Tenders, endorsed "Tender for Cast Iron Pipes," are to be delivered at my office before Noon on Tuesday, the 14th February, 1905, and the schedule of quantities, with every item legibly priced in ink, and with the columns added up to the exact total amounts of the Tender, must be delivered in a sealed envelope addressed to the Engineer on or before Noon on Wednesday, February 15th, 1905.

The Council do not bind themselves to accept the lowest or any Tender, or to defray any expenses in connection with tendering.

By order,
T. ANEURYN REES,
Clerk to the Council.

Town Hall, Merthyr Tydfil,
January 26th, 1905.

APPOINTMENTS OPEN.

EAST INDIAN RAILWAY.—ASSISTANT LOCOMOTIVE SUPERINTENDENT.

ASSISTANT CARRIAGE AND WAGON SUPERINTENDENT.

The Directors of the East Indian Railway Company are prepared to receive **APPLICATIONS** (by letter only) from duly qualified candidates for **APPOINTMENT** as **ASSISTANTS** in the Locomotive and Carriage and Wagon Departments of the Company in India.

Candidates must have had a good general and technical education and have served either pupilage or apprenticeship in the loco. or carriage and wagon workshops of a British railway or large loco. or carriage and wagon builders, as the case may be.

Candidates for the loco. appointment should not be less than 25 years of age, and preference will be given to those experienced in workshop supervision.

Salary, Rupees 350, rising to Rupees 400, per calendar month.

Candidates for the carriage and wagon appointment should be about 25 years of age, and preference will be given to those who have had experience in the construction of iron and steel wagon work, as well as the woodwork connected with carriage building and "running" work.

Salary, Rupees 250, rising to Rupees 350, per calendar month.

Terms : A four years' agreement in the first instance, with first-class free passage to India.

The selected candidates will be required to pass a medical examination by the Company's Consulting Physician before appointment.

Letters of application, accompanied by a brief record, in chronological order, of the applicant's career, with dates, together with copies (not originals) of testimonials, and a medical certificate of fitness for residence in India, which cannot be returned, should be addressed to the undersigned not later than Saturday, the 11th February, 1905.

By order,
C. W. YOUNG,
Secretary.

28-30, Nicholas Lane, London, E.C.,
January 19th, 1905.

THE VICTORIA UNIVERSITY OF MANCHESTER.

The Council desires to proceed to the APPOINTMENT of a PROFESSOR of ENGINEERING.

The Professor will be responsible for the organisation of the Engineering Department, and will have the direction of the Engineering Laboratory.

He may take a consulting practice under specified conditions.

His stipend will be composed of a fixed salary and a share of the fees, and the Council guarantee that the total income will not be less than £1,000 per annum during the first three years.

A detailed statement of the conditions of appointment may be obtained from the Registrar.

Applications, with references and such testimonials (not exceeding three in number) as the candidate may desire, should be sent on or before February 15th to the Registrar.

COUNTY OF LONDON.

THE LONDON COUNTY COUNCIL requires the

SERVICES OF AN ENGINEERING ASSISTANT,

not over 45 years of age, who is a Member or Associate Member of the Institution of Civil Engineers, and who has had considerable experience both in the design and construction of engineering works. Preference will be given to a candidate who has had experience of large city improvement works and parliamentary procedure, and has had charge of a numerous drawing office staff. The salary attached to the appointment will be £500 a year, and the gentleman appointed will hold his office during the pleasure of the Council, will be required to give his whole time to the duties of his office, and will not be allowed to take any private practice, to hold any other appointment, or to occupy any other paid position, and any fees received by him either as a witness or in any other capacity are to be paid to the Council ; and will further be required to conform to the Council's regulations in respect of the superannuation and provident fund, in the benefits of which he will participate.

Forms of application can be obtained either by applying personally or by sending a stamped addressed foolscap envelope to the "Clerk of the London County Council, Spring Gardens, S.W.," and the latest time for receiving applications is Ten a.m. on Monday, February 20th, 1905. Any application which fails to comply with the terms of this advertisement will not be laid before the Council. Personal canvassing of members of the Council is strictly prohibited.

G. L. GOMME,
Clerk of the London County Council.

The County Hall, Spring Gardens, S.W.,
January 31st, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Hartley & Sugden, Ltd., Halifax.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus London E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

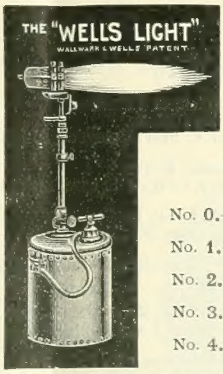
Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.
E. J. & J. Pearson, Ltd., Stourbridge.

PAGE'S WEEKLY Wells' Specialities



PORTABLE LIGHT FROM OIL

UP TO 4,000 CANDLE POWER.

Adopted by 26 Governments and all Leading Firms. Over 17,000 sold. Over 1,500 supplied to British and Foreign Railways.

EACH LAMP GUARANTEED.

Horizontal Flame Unaffected by Weather.

	PRICE COMPLETE.
No. 0.—500 Candles, small hand pattern, for petroleum	£7 7 0
No. 1.—1,500 Candles, hand pattern, with No. 2 size burner for Tar Oil ...	£10 0 0
No. 2.—1,500 or 2,000 Candles, useful and portable pattern	£15 10 0
No. 3.—2,500 or 3,500 Candles, Manchester Ship Canal pattern ...	£16 10 0
No. 4.—3,500 or 4,000 Candles. A most powerful lamp	£17 15 0

These Lamps are arranged to burn Kerosene or Petroleum when sent to Foreign Countries; but in Great Britain our Special Wells Oil is supplied, which is half the price, and gives 30 per cent. more light. Special prices for our oil may be had on application to our Agents or direct to us.

For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil, burning six hours.

Price **£3** each.

Extra Burners **3/-** each.

WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity, 7 pints. Burning about 7 hours.

Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal, for Lightness and Strength, with large Capacity.

Price, with Single Burner...	16/- each.
,, Double ,, ...	19/- ,,
Tripod Stands	3/- ,,
Extra Burners	2/- ,,

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,
LONDON, N.W.

WELLS' "LIGHTNING PAINTER."

(WALLWORK AND WELLS' PATENTS.)

PAINTING BY MACHINE.

Great Saving in Time, Paint, and Labour.

PAINTING SPEED—3 square yards a minute.

The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air, either from existing air main or from our special Compressors.

No. 1 Painter (as above Illustration) ...	£25 0 0
No. 2 ,, ...	£30 0 0
No. 3 ,, ...	£35 0 0
Single Air Compressor	£17 10 0
Double Air Compressor	£27 0 0

HAND AIR COMPRESSORS,
Paint Holder and Sprayer Combined.

Invaluable for ELECTRICAL WORK, STENCILLING, ORNAMENTING, DECORATING, &c., or any class of painting where the work is not very heavy or continuous.

Price, Complete ... ... £16.

Hand Sprayer and Hose supplied separately, **£9.**

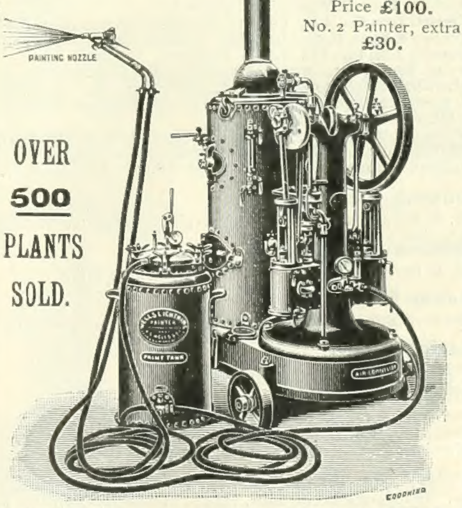
Supplied to **12** Governments' principal Railways, and leading Firms in Great Britain.

VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price **£100.**

No. 2 Painter, extra **£30.**

OVER 500 PLANTS SOLD.



Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

Gauges.
Klinger, Richard & Co., 66, Fenchurch Street, London, E.C.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Jointing Materials.
Richard Klinger & Co., 66, Fenchurch Street, London, E.C.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Britannia Engineering Co., Ltd., Colchester, England.
C. W. Burton Griffiths and Co., 1, 2, & 3, Ludgate Square, Ludgate Hill, London, E.C.
Chas. Churchill & Co., Ltd., 9-15, Leonard Street, London, E.C.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
John Stirk & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Whitman & Barnes Manufacturing Co., 149, Queen Victoria Street, London, E.C.
Charles Winn & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W C

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY Miscellaneous

Boltons' Downtake Superheater WITH DOUBLE CIRCULATION.

IMPROVED BOX AND "FIELD" TUBES. (PATENTED.)

Simple and Reliable. Readily Applied. Inexpensive.

Saves 10 to 15 %

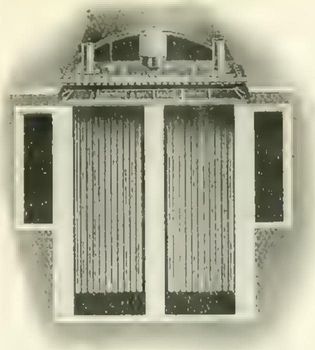
Is made of Steel throughout.

A large number working in—
Textile Mills,
Paper Works,
Collieries,
Electricity Stations,
Flour Mills, etc.

Suitable for any Working Pressure up to 200 lbs. per square inch.

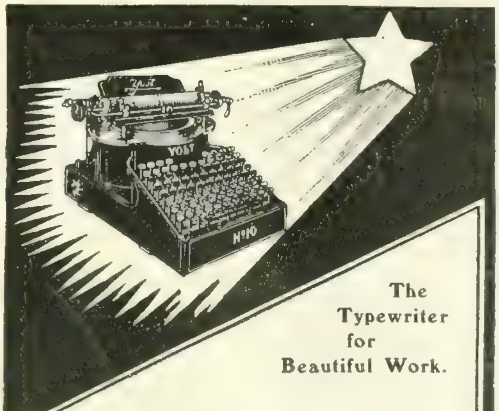
Approved of by Leading Engineers and Insurance Co.'s.

REPEAT ORDERS BEING GIVEN.



PATENTEES AND SOLE MAKERS:—

A. BOLTON & CO.,
Engineers and Superheating Specialists,
49, Deansgate, MANCHESTER.



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SWIFT, QUIET, & CONVENIENT.

Made of Best Material only

ILLUSTRATED BOOKLET POST FREE.

THE YŌST TYPEWRITER CO., Limited,
50, Holborn Viaduct, London, E.C.

FOR THE BEST BOOKS BEARING ON THE INDUSTRIES DEALT WITH IN "PAGE'S WEEKLY," viz., ENGINEERING, ELECTRICAL, IRON AND STEEL, MINING AND SHIPBUILDING, ASK FOR CATALOGUE, CHARLES GRIFFIN & CO., LTD., 12, EXETER STREET, STRAND, LONDON, AND SEE SPECIAL ADVERTISEMENT ALTERNATE WEEKS.

CYCLONE FANS FOR Induced Draught.

MATTHEWS & YATES, Ltd.,
Swinton, Manchester.

J. B. TREASURE & Co.

Excelsior Fire-Polished

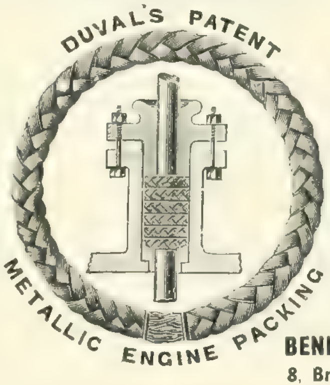
GAUGE GLASSES,

LUBRICATORS,

INDIA-RUBBER WASHERS,

&c., &c.

Vauxhall Road, Liverpool.



A PURE
METALLIC PACKING
FOR THE
HIGHEST SUPERHEATED STEAM and HIGH-PRESSURE ENGINES,
Marine & Stationary.

Lasts for years and used in the same way as ordinary Soft.

Write for . . Illustrated Booklet.

BENNETT VON DER HEYDE
8, Brown St., MANCHESTER.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan 67 and 69, Chancery London, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co 21, Lime Street, London, E.C

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
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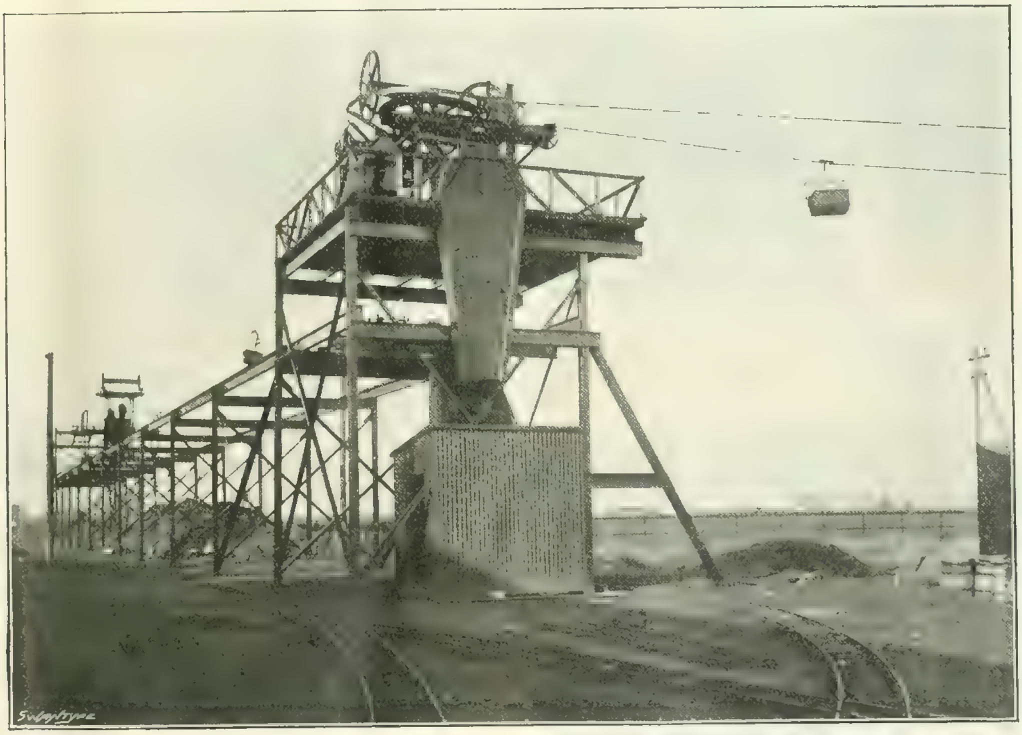

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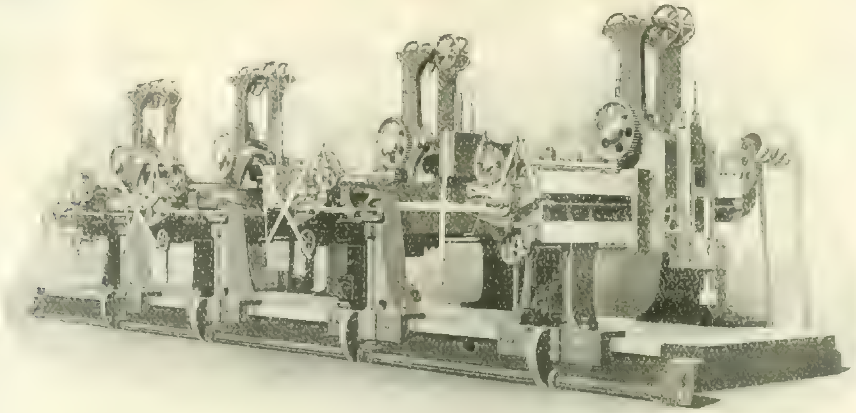

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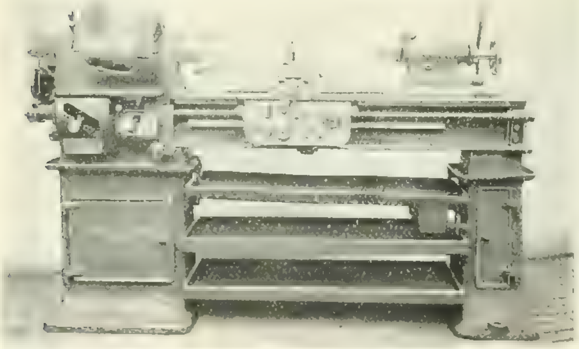

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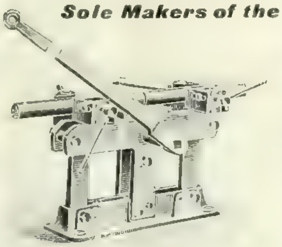

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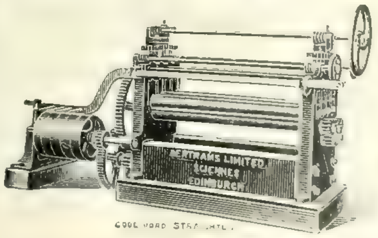

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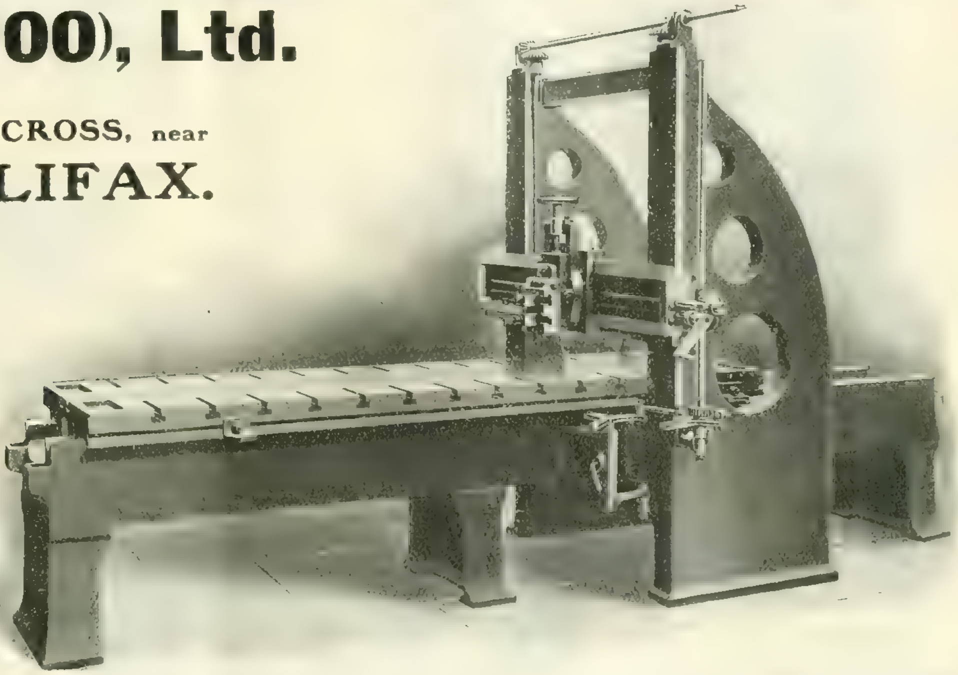

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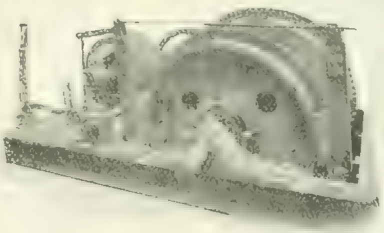

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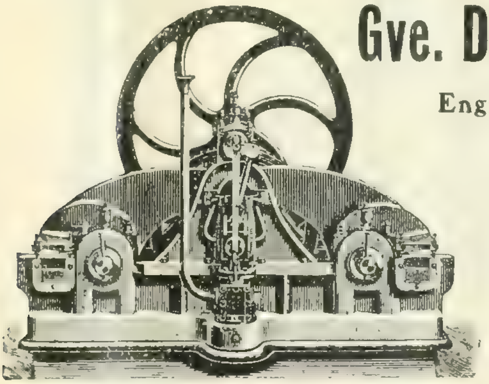

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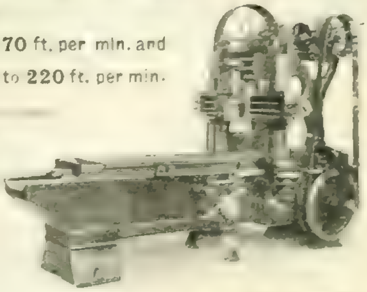

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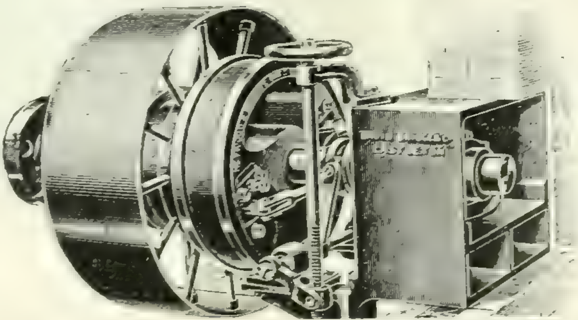

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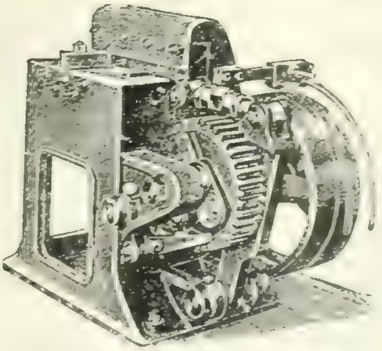

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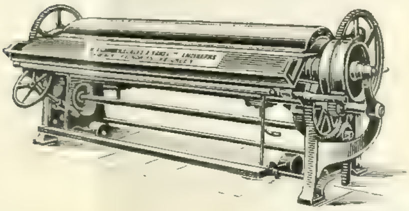

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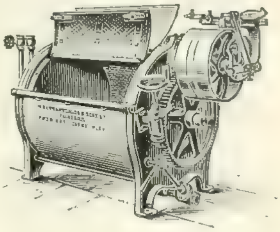

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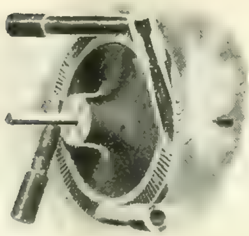

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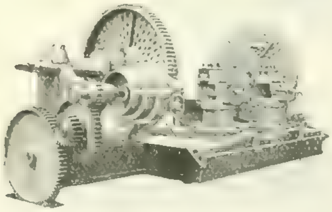

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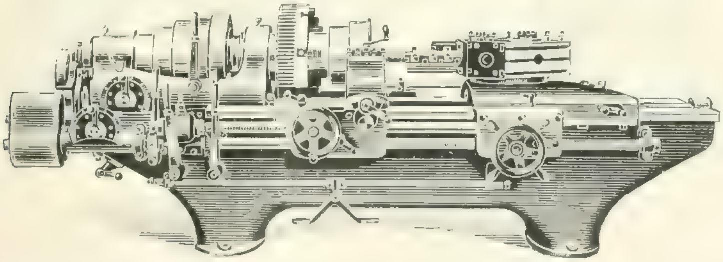

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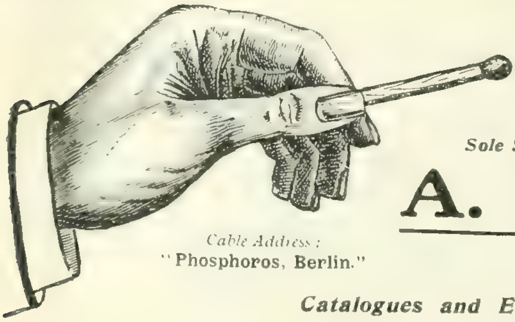

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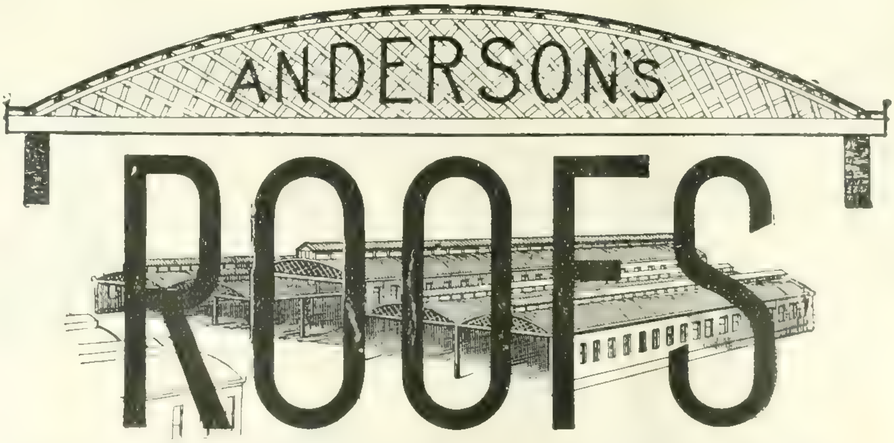

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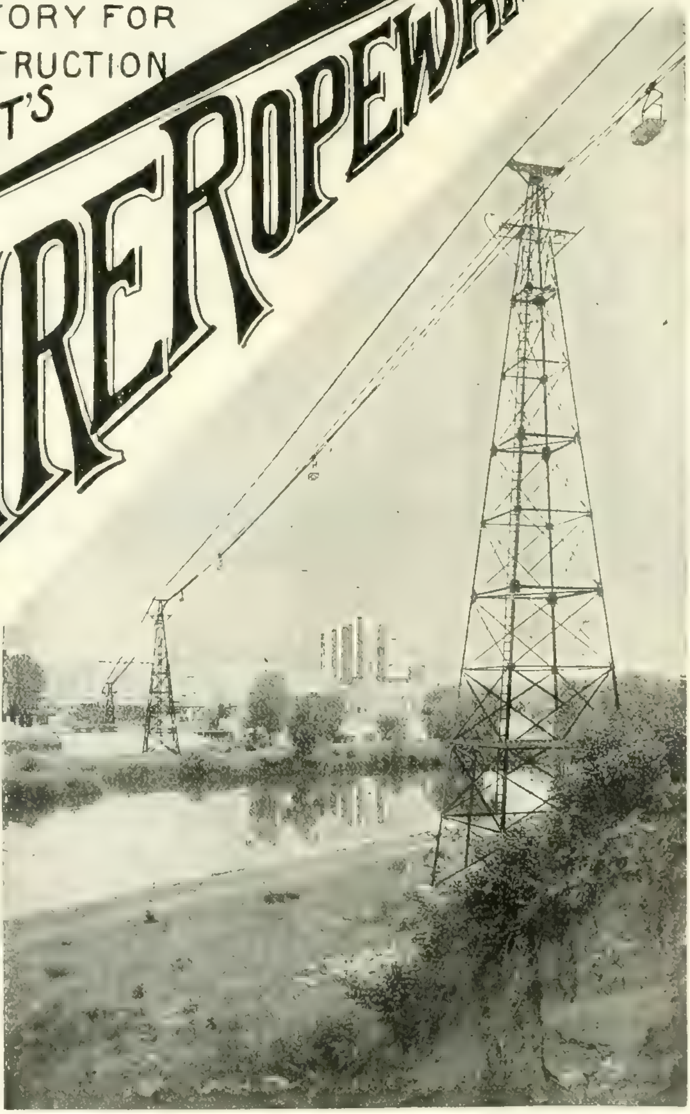

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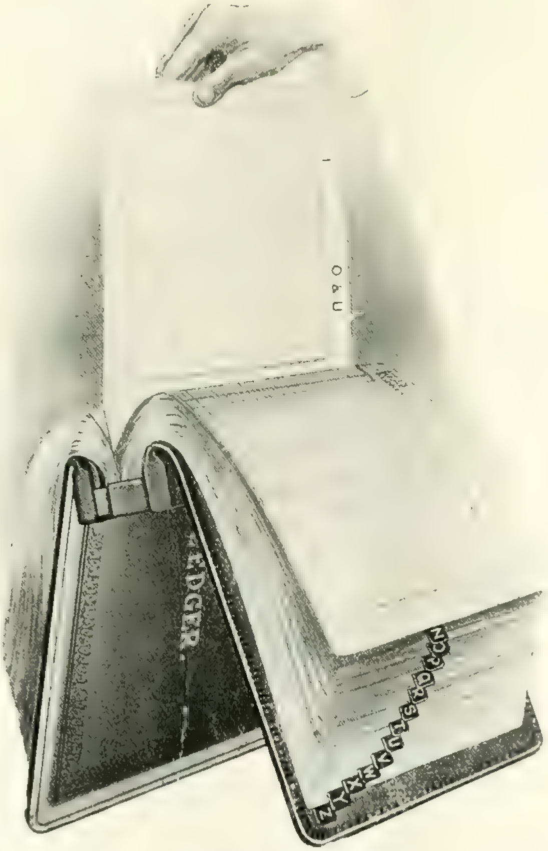

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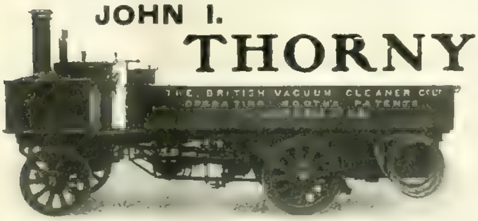
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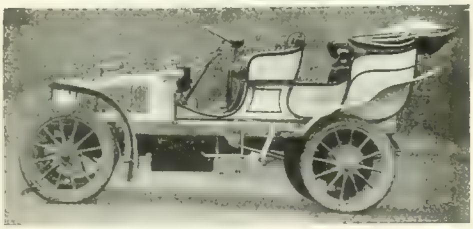

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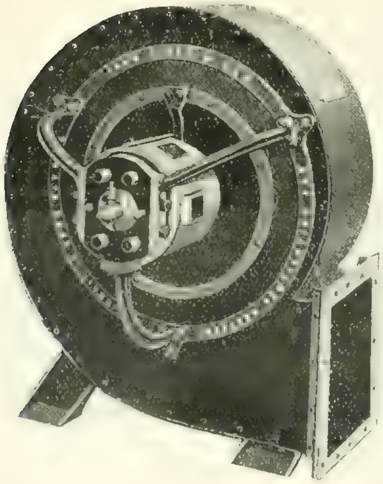

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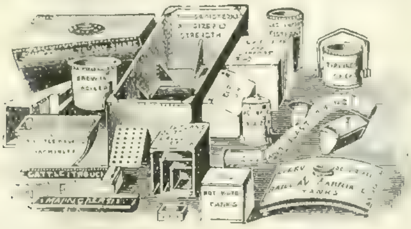

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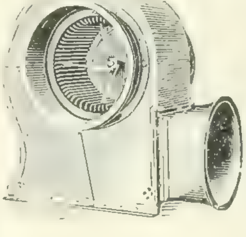

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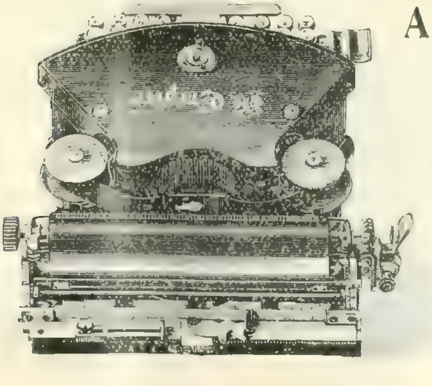

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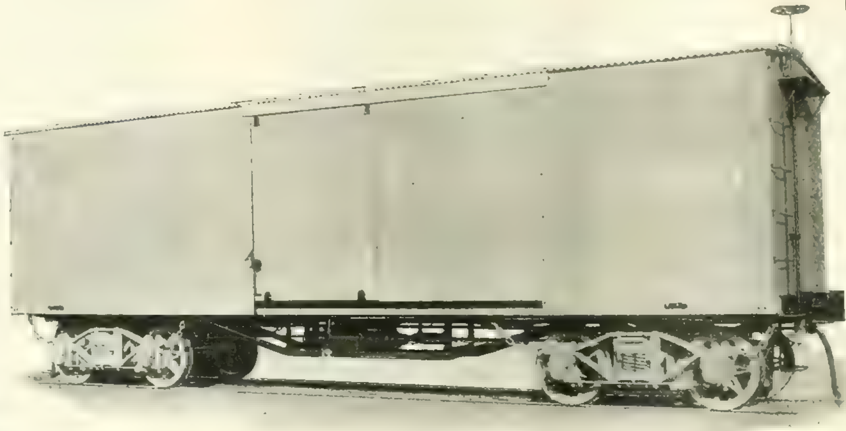

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VI. LONDON, FRIDAY, FEBRUARY 10, 1905. No. 22.

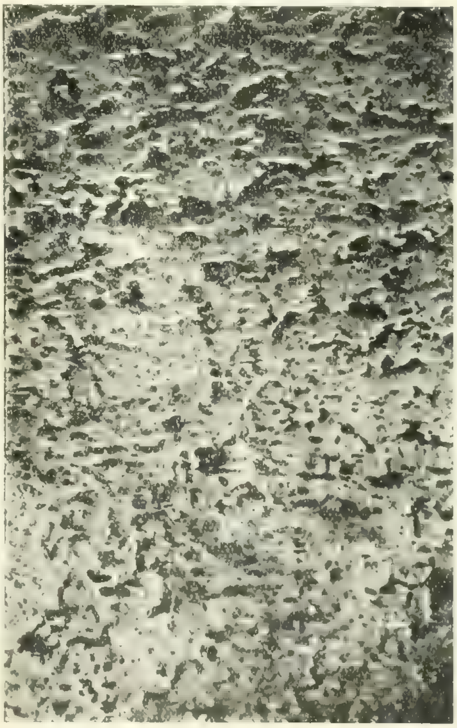
The Offices of "Page's Weekly,"
Wednesday, Midnight.

AN important side issue connected with the report of the Commission on Coal Supplies dealt with elsewhere, is introduced by the following outspoken opinion upon our mining statistics : In the course of our inquiries attention has been drawn to the fact that our mining statistics are inadequate and sometimes misleading. In 1893 the Mining Royalties Commission recommended that the Department of Mines in the Home Office should be reorganised and extended with such additional statutory powers as might be necessary for the purpose of collecting and publishing accurate information with regard to mines and minerals generally, and certain specified matters in particular. In view of that recommendation a Departmental Committee of the Home Office was appointed in 1895 to consider the whole question, and they reported that, although it would be extremely difficult to carry out some of the special recommendations of the Commission, many of them could be adopted at once. The Committee made some further recommendations and suggestions, and pointed out the best methods of obtaining the information desired. Had these suggestions been carried out, say the Commissioners, it would have greatly assisted our inquiries.

The chief objections to the present system appear to be :—

(1) That there is considerable delay in publishing the statistics ;

(2) That information as to important subjects, such as the use of coal-cutting machines and

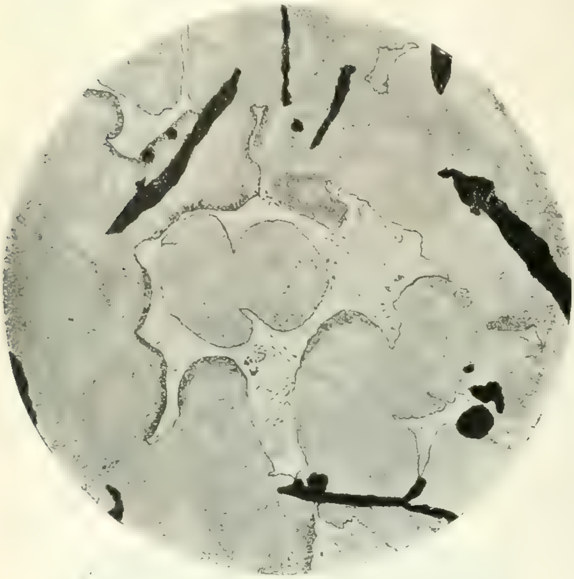


GREY CAST IRON MAGNIFIED 50 DIAMETERS.

Microscopically cast iron may be regarded as a mass of pure iron distributed through which are varying amounts of impurities. Under a low magnification it does not reveal its ultimate structure but gives rather a general or bird's-eye view of the structural arrangement as shown above. (*See also page 280.*)

the manufacture of coke and briquettes is omitted, or only occasionally given;

(3) That, although there is a great deal of information readily obtainable as to the consumption of coal in different industries, no attempt has yet been made to collect and publish it; and



GREY CAST IRON MAGNIFIED 230 DIAMETERS.

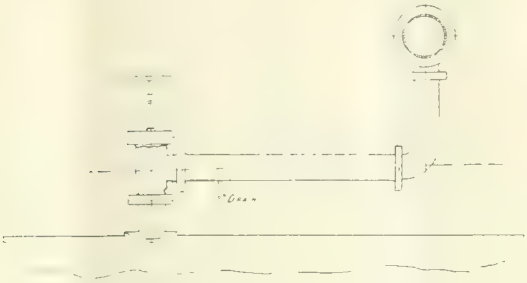
In this photo-micrograph the black streaks and dots of graphite will readily be recognised. The pearlite is laminated in a few places, but the majority of it is granulated in form. The large irregular network in the centre completely enclosing the area of perlite represents the phosphide eutectic.

(4) That much information relating to coal is published by departments other than the Home Office in the shape of Parliamentary Returns, etc.

We venture to think that it would be of great public advantage if accurate information upon the above-mentioned matters were collected and published by one authority, and with greater promptness than at present, and generally we desire to endorse the recommendations of the Mining Royalties Commission.—[A plain statement and one which, we think, needs no further emphasis.]

The report of the Preliminary inquiry (No. 1,530) has been issued relating to an explosion from a stop-valve chest at the Soap and Candle Works of the Co-operative Wholesale Society, Ltd., Irlam, near Manchester. In this, the upper part of the cylindrical portion of the cast-iron stop-valve chest fractured around its circumference, and allowed the steam at a pressure of about 58 lb. per square inch to escape from four boilers. The explosion, appears to have been due to water hammer action caused by water lodging in No. 3 junction steam pipe and stop-valve chest, owing to the drain pipe having become choked. The works are supplied with steam from a range of six Lancashire boilers, each 30 ft. long by 8 ft. in diameter, with the usual mountings and saftey valves adjusted to work at a pressure of 60 lb. per square inch. The stop valve on each boiler is connected by means of a junction pipe 7 in. in diameter, 5 ft. 6 in. long horizontally, and about 38 in. vertically, to the main steam pipe, which is 12 in. in diameter internally. There is a $\frac{3}{4}$-in. drain cock placed about 12 in. from the stop valve end of the junction pipe. This drain leads into a main drain pipe, 2 in. in diameter, and thence to a steam trap at the outside of the range of boilers. As steam is required continuously at the works, the practice is that one or two boilers are laid off for cleaning, while the others are under steam. At the time of the explosion, Nos. 1 and 2 and 5 and 6 boilers were under steam, and Nos. 3 and 4 were opened up for cleaning purposes. On the previous evening three of the Society's workmen were scaling and cleaning the inside of No. 3 boiler, from 6 p.m. to 8.30 p.m., and before going inside, they screwed the stop valve hard down to prevent any leakage of water into the boiler where they were working, and, for further security, locked the wheel of the stop valve in accordance with the Company's instructions.

The explosion occurred at about 6.20 a.m. on the morning after the men had been at work in the boiler. At that time, as before stated, Nos. 3 and 4 boilers were laid off, and a portion of the main steam pipe opposite No. 3 boiler was uncovered and exposed. This is the lowest portion of the main steam pipe, as it rises from here towards the soapery 1 in. in 32 ft., and the conditions were, therefore, most favourable for an accumulation of water to take place at this point, which could only be relieved by the drain on No. 3 junction pipe.



From the evidence of Mr. W. Cheetham, the engineer of the works, it would appear that the drain cock on No. 3 junction pipe was open when he examined it after the explosion. He did not examine the other portions of the drain pipe to ascertain if they were clear, but was under the impression that this drain pipe was choked with sediment in the bend at the lower part of the pipe.

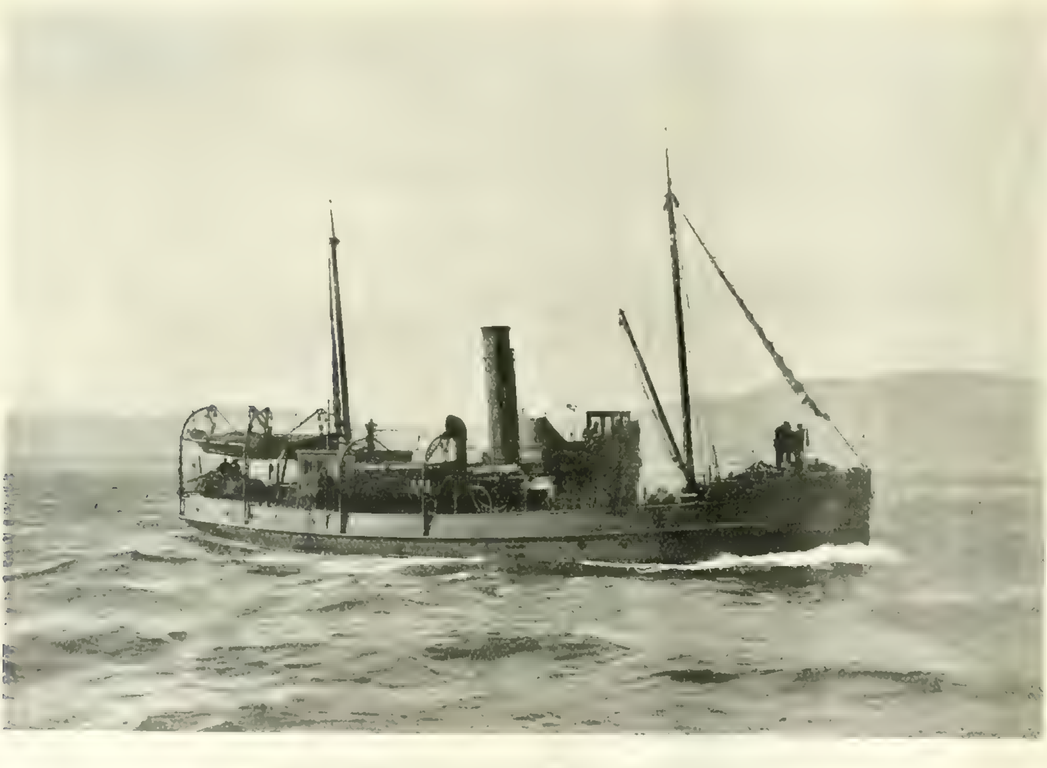
The $\frac{3}{4}$-in. drain cock on the junction pipe is situated 12 in. from the stop valve. The junction pipe falls $1\frac{1}{4}$ in. in its length of 5 ft. 6 in. from the stop valve, therefore, it is only reasonable to expect that when steam was not passing, there would be always a small quantity of water lodging at the bottom of the bend of the junction pipe, which the drain could not effectively clear away, but it appears that this junction pipe had before the explosion become full of water during a temporary choking of the drain pipe, and the latter pipe was subsequently cleared by the fluctuation of the pressure in the main steam pipe, due to the opening of three 2-in. stop valves in the soapery end of the main steam pipe by the foreman soap-boiler, who, in his evidence, stated that he was in the act of carrying out this operation when the explosion occurred.

When the stop valve was examined after the explosion, it was found that the fracture extended around the circumference of the chest under the upper flange. The fracture showed that the metal was of good quality and with no indications of any flaws prior to the explosion. It was also noted that the gun-metal spindle was bent about $\frac{1}{4}$ in. in about 8 in. between the top of the valve and the stuffing-box. This had probably been caused by pressure, owing to the different ratio of expansion between the gun-metal spindle and the cast-iron of the stop valve, and a stress may have been set up thereby upon the cylindrical portion of the chest at the time it received the impact of water, which resulted in the explosion. A new stop valve of an improved pattern has now been fitted, which is designed to allow free expansion of the gun-metal spindle to take place in the stop-valve chest. Arrangements are also being made by the Society's engineer so that a more effective system of draining the water from the steam pipes will be adopted.

The observations of the Engineer Surveyor-in-Chief state that "the explosion appears have been caused by the impact of water on the chest. The drain cock on the steam pipe attached to the chest is said to have been found open after the explosion, it is, however, probable that it, or a portion of the drain pipe, had become choked and thereby led to an accumulation of water, and that the level of this water in the pipe was in some way altered, but how the water was set in motion does not appear to have been ascertained."

The subject of "Gold from Sea Water," which has recently been ventilated in the daily press, might at first sight appear to be anticipatory of what journalists call the "silly season," and one might be pardoned for recalling in connection therewith a certain gentleman created by Dickens, whose speciality was gold from paving stones. The matter is being seriously taken up, however, and, although Sir William Ramsay, K.C.B., lays particular emphasis upon the fact that the process is still in an experimental stage, he is able to say that nearly one grain of gold may be obtained to one ton of salt water; the actual result obtained being over 2d. per ton of water, which may still further be improved upon by experience. One grain of gold is worth practically $2\frac{1}{8}$d. We are given to understand that the gold can not only be obtained, but that the Snell process can be placed upon an eminently satisfactory commercial basis. The prospect is certainly alluring, except perhaps to the owners of cyanide plants. Beside it, the realisation of the Philosopher's Stone would be a poor achievement. If the investigations referred to had been given on a less authority than that of Sir William Ramsay, there might have been some temptation to take the grain of gold with a grain of salt. Under the circumstances, we can only accept the authority given, and await further details. A general rush for the seaside need not be contemplated, however, for the process is in the hands of a syndicate, and it is scarcely likely that they will send a précis of their method on receipt of a post-card.

If gold were as cheap or cheaper than guano one is tempted to wonder what would become of the currency. The revolutionary effect of such a contingency however we must leave for the consideration of more philosophical minds. That gold exists in sea water was first pointed out by Sonstadt, in 1872. Professor Liversidge, of Sydney, also made a systematic examination of sea water, and his results agree with those of Professor Ramsay.



THE COASTGUARD SCREW STEAMER "SQUIRREL."
Built and engined by Messrs. Workman, Clark and Co., Ltd. The vessel has just completed her trials.
(*See page* 313.)

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

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Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

Mr. Thomas C. Hutchinson, of the Skinningrove Ironworks, has been elected president of the Cleveland Ironmasters' Association.

Over twelve tons of excellent bituminous coal were raised on February 2nd from the first workable seam at Dover Colliery Works, near the Shakespeare Cliff.

The 58th annual meeting of the Institution of Mechanical Engineers will be held on the 17th inst., at Storey's Gate.

Sir Lowthian Bell, left estate of the gross value of £768,676 7s. 2d., of which the net personality has been sworn at £674,317 8s. 1d.

The London County Council has placed an order for the construction of a new motor fire engine for the use of the London Fire Brigade. While attaining a very high rate of speed, it will be provided with pumps of the latest pattern. The contract price is £1,260.

Presiding as Chancellor at the annual meeting of the Court of Governors of the Birmingham University, Mr. Chamberlain reviewed the progress made by the University since its inauguration, and announced that the Chancellor of the Exchequer had undertaken to propose in the next Budget the doubling of the Government grants for University education.

Messrs. M. Glover and Co., of Leeds, specialists in patent firewood machinery, have been able, in consequence of an extension of their works, to avail themselves of more commodious offices. These are to be found at Low Hall Gateway and supersede the old offices at the Holbeck Works. As far as correspondence is concerned however, it is to be noted that all letters may be addressed as before to Holbeck Lane, Leeds.

Messrs. John Henderson and Co. have established an office at 26, Victoria Street, London, S.W., and we are advised that an engineer or representative will be available at all times for the transaction of urgent and other business in London and district. The registered address for London telegrams is "Cableways"; the telephone number 431 Victoria.

Lord Middleton, in opening the monthly meeting of the Council of the Royal Agricultural Society, announced with much regret the death of their able and esteemed colleague, Mr. James E. Ransome, of Ipswich. Sir Jacob Wilson was appointed honorary director for the 1905 show, in place of Mr. Crutchley, resigned. The stewards for the show were appointed, those for implements being Mr. W. A. Prout, Mr. R. Neville Grenville, and Captain W. S. B. Levett.

Wind-Pressure Gauge and Recorder.

To guard against accidents on the well-known Levens viaduct, the Furness Company have erected an ingenious automatic signalling apparatus. It consists of a combined wind-pressure gauge and recorder, and is connected with an electric arrangement by means of which bells are set ringing in distant signal cabins. These bells will continue to ring so long as the velocity of the wind on the viaduct is dangerous to passing trains, and consequently all traffic will be stopped. A mail train was blown over on this viaduct during a gale in February, 1903. Messrs. Elliott Brothers, who made this apparatus, inform us that it is mounted in a frame built up of steel angles; on two sides of the frame, boards are fixed carried in on hinges and kept normally in the vertical position by means of springs, which are similar in construction to that used in an ordinary steam engine indicator. The strength of the spring is so reckoned out in relation to the area of the board that a pressure of so many pounds per foot can be recorded on the paper chart which is moved by the clock of the recording instrument. Two pens are fitted—one controlled by each board; if the pressure on either board remains constant then the pen will continue to draw a straight line, but an increase or a decrease of pressure will give a deviation of the line at a point on the paper corresponding to the time that this change of pressure takes place.

Institution of Naval Architects.

The annual meetings of the Institution of Naval Architects will be held on Wednesday, April 12th, and the two following days, in the Hall of the Society of Arts, John-street, Adelphi, W.C. (by kind permission of the Council). The Right Hon. the Earl of Glasgow, G.C.M.G., LL.D., president, will occupy the chair. The annual dinner will be held on Wednesday, April 12th, at the Hotel Cecil.

AN ENGINEERING POSTCARD.

The application of the illustrated post-card to business purposes seems to be gaining rapid favour. The latest series to come under our notice has been issued by Messrs. Flocton, Tompkin and Co., Ltd., of Newhall Steel Works, Sheffield. The specimen we have selected for reproduction calls attention once more to the old-fashioned production of high grades of steel by the class of furnace known as "melting holes." Messrs. Flocton, Tompkin and Co., Ltd., are specialising on high-speed air hardening steel, and it is interesting to note that they have extended this form of crucible melting furnace, in the face of all the recommendations of modern furnaces in the shape of gas, etc.

"POWER."

(A Series of Weekly Notes, continued from page 224.)

THE water contained in a steam boiler receives its heat from the plates or tubes by conduction, but is almost powerless to pass on the heat to neighbouring particles in this way. For example, if heat be applied to the upper surface of a vertical column of water, local evaporation may be set up, but little or no heat will be communicated to the general body of fluid. Heat is only distributed through the mass of water by convection, which may be defined as "the power possessed by fluids of conveying heat acquired at one place to another place." The difference between conduction and convection may be illustrated thus: imagine a crowd waiting at the box-office of a theatre, or for tickets at a railway station. If the tickets, as fast as they were issued, were passed on from one individual to another until they became gradually distributed throughout the mass—that would be conduction, the method by which heat is propagated by metals and solids. If, on the other hand, each person as he received his ticket, passed on bearing it away with him, and making room for the next person, that would be an exact analogue of the process of convection, the mode by which heat is conveyed in fluids or gases. It will be seen at once that circulation is the essential condition of heat transference through water.

Now, if we take the same tube of water which we have vainly endeavoured to heat from the top downwards, and apply the source of heat to the bottom; provided the heat be intense enough we shall find that the water, unable to part with its heat by conduction at all, and in the absence of any system of circulation, will generate steam at the bottom, and very soon expel the whole contents with violence. The upward and downward currents crowd and jostle each other precisely as two opposite-tending bodies of people would do in a narrow passage, with the result that confusion ensues and the weaker body is driven forth by the stronger. Under the name of "priming" the phenomenon is observable in many steam boilers. Pursuing the analogy one step further, suppose that in the passage a central rail or partition were set up, then the two streams of people would be able to pass each other in an orderly and peaceful manner, and the essential condition of circulation would be achieved.

In a type of steam boiler, less used now than formerly, there were vertical tubes, closed at their lower ends depending from the roof of the firebox. Into each of these tubes, which were only about two inches in diameter, was dropped a small central tube, about 1 in. bore which served the purpose of the rail in the passage and separated the ascending and descending currents. If this inner tube ever became worn out and dropped away from the little tripod which suspended it, the lower part of the outer tube, exposed to the fierce heat, and receiving no water became red-hot and rapidly burnt out. A similar want of circulation, though not attended with such bad effects, may be noticed in boilers with internal flues. In a Cornish or Lancashire boilers the water near the bottom may be nearly cold for hours after the boiler is generating steam above it.

Convection in itself is the effect of gravity. The heated particles rise through the surrounding body of water in virtue of their lessened specific gravity due to expansion. This continues until steam bubbles are formed in the water at the source of heat, when the rate of displacement becomes much more rapid, as the mixed current of steam and water is, of course, still lighter than the heated water alone. Heat continuing to be applied, this formation and projection upwards of steam bubbles becomes more and more rapid, and, provided that circulation is unimpeded, may go on safely without overheating the boiler plates (if the surfaces are clean) even though exposed to the most intense heat.

On the contrary, when circulation is hampered and the rising steam bubbles are unable to get freely away from the heating surfaces, a film or layer of highly heated steam remains in contact with the surface, causing a rise in temperature of the plate, sometimes to a dangerous extent. Should this continue, the plate or tube may become so hot that the water cannot approach it at all, being kept off by the emission of radiant heat. Hutton estimates that the temperatures of a furnace plate from which the water is being repelled in this way, may, within one minute rise to 1,100 deg. F., a condition of imminent danger to the boiler and its surroundings. It being so vitally important to provide facilities for circulation in a steam boiler we may conclude the best of all heating surface in this regard, to be a horizontal plate with water above as the roof of a locomotive firebox, for example, if not obstructed by bridge-stays; and that the worst form—if indeed it can be called heating-surface—is the exact converse of this, namely, with the heat above the water.

NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)

GREAT BRITAIN.

AN inspection of the machinery of the new battleship *King Edward VII.* was held by the Committee of Machinery Designs last week. This vessel is undergoing her commissioning trials in the course of the next few days or so, but the alterations to her furnaces to allow of the consumption of oil fuel will not then be complete. She has already satisfactorily passed through her dynamo trials. The two sister ships, *New Zealand* and *Britannia*, building at Portsmouth, are progressing rapidly. The former is now practically ready for her gunnery and steam trials, all her armament being on board, and the barbettes finally closed in. The *Britannia* is now in dry dock, having her side armour fitted and a large staff of men are at work on her.

The new scout, *Sentinel*, has undergone her steam trials, and made a speed of 25·249 knots with 17,500 h.p., and a moderate consumption of coal. On a special trial for an endurance test, she succeeded in steaming at full speed for nearly ten hours.

A redistribution of the destroyer flotillas in the Mediterranean has been carried out, and there are now five divisions, four based on Malta, and one on Gibraltar. The composition of these divisions is—five vessels forming a working flotilla in commission, a reserve of three vessels, and an additional reserve of one vessel. The main object of this redistribution is to gather together as far as possible all vessels of the same type, in order that the spare parts of the machinery and boilers may be interchangeable, thus reducing the amount of new fittings and parts which each parent ship will have to store.

FRANCE.

The new French Minister of Marine, M. Gaston Thomson, has announced his intention of inculcating a vigorous policy, and he says it is very important that France should have the best types of vessel only. M. Thomson does not come to his duties quite unacquainted with naval matters, as he was reporter on the naval budget for 1899, and was serving at the time M. Rouvier asked him to take the portfolio, as Vice-President of the Extra Parliamentary Committee on the Navy.

Progress with the battleships *Democratie* and *Republique* at Brest has been slow, principally on account of the modifications introduced into the design of the former vessel. The armoured cruiser *Victor Hugo* has had her masts stepped, and she is now in dry dock having her propellers, submerged torpedo tubes, and other under-water fittings placed in position. It is announced that in the battleships of the *Republique* class 7·63-in. guns are to be substituted for the 6.48-in. guns originally prescribed. Further it is stated that all these vessels are to be supplied with large tube Niclausse or Belleville boilers.

JAPAN.

The programme of Naval construction upon which the Japanese Government is about to embark, and which is to be carried out almost in its entirety in the Japanese naval yards is an ambitious one, and the results will be eagerly watched by naval engineers. The actual constitution of the programme has been given in great detail by one newspaper correspondent, and, according to his report, the following is the number and class of vessels to be built :—

One battleship of 19,000 tons and 18·25 knots speed, at Yokosuka ; two armoured cruisers of about 10,000 tons at Kure ; a number of destroyers and torpedo-boats, and (to be acquired by purchase) fifteen submarines.

The most noteworthy feature about the programme after the enormous displacement of the battleship design, is the armament of the armoured cruisers. It is reported that these vessels are to carry four 12 in. guns, as main armament, and yet are to develop a speed of 20 knots. How this plan will work remains to be seen, but the fact that no other nation has yet ventured to mount four such enormous pieces as the modern 12-in. guns, in one vessel of the armoured cruiser class, argues that either the Japanese have obtained a very remarkable design, such as has not even suggested itself as practicable to European naval architects, or that they will have to modify their plans. It must, of course, be remembered that Japan has two vessels under construction in this country, the *Kashima* and *Katori*, building by Vickers and Elswick respectively.

OLYMPIA MOTOR SHOW.

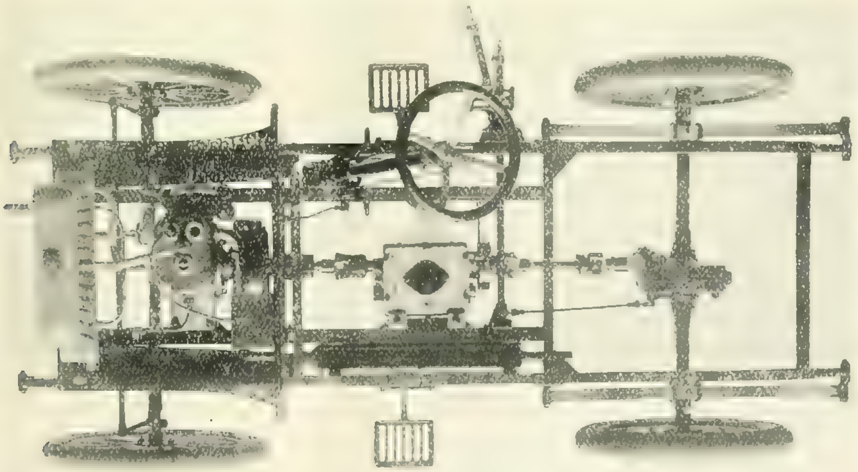
THE great show at Olympia opens to-day, and it promises to be not only representative, but to some extent at least international in character. It may be said, at the outset, that the Society of Motor Manufacturers and Traders, who are responsible for the exhibition deserve that success should attend their efforts for no trouble and scarcely any expense has been spared to give the show a suitable setting. The hall, which is 450 ft. long by 250 ft. wide, has been levelled by the removal of the stage and arena, and a new cement floor has been constructed. This space is devoted to the exhibition of motor-cars, whilst the annexe is being utilised for motor-boats. The gallery, which is 40 ft. wide, and over a quarter of a mile in circuit, contains the exhibits of tyres and accessories. The list of exhibitors is an imposing one, not only in point of numbers, but from the fact that it includes the best known names connected with motor manufacture, and some of the exhibits are of a character which call for detailed notice from the engineering side. In all branches of motor manufacture advances are to be recorded. In particular, the number of firms exhibiting heavy vehicles attracts attention in view of the developments which are taking place in connection with this important branch of traction. Some of the exhibits in this section are of a particularly interesting character, and will be noticed in future issues of PAGE'S WEEKLY, The Brush Electrical Engineering Company, Armstrong, Whitworth, and Co., Ltd., Thornycrofts' Steam Vehicle Company, Daimler Motor Company, Ransome, Sons and Jefferies, and Clarkson, Ltd., are among those represented in this group of exhibits.

In the annexe, where the boat exhibits are housed, the name of Thornycroft is again associated with an important exhibit, while the Wolseley Company, the Mitcham Motor Company, Gaines Reversible Propeller Company, the Neptune Motor Company, and the Simms Manufacturing Company have stands in this section.

The exhibit selected for notice to-day is that of Alldays and Onions Pneumatic Engineering Company, one of the oldest engineering firms in the country.

The illustration below shows the chassis of Alldays' light car. The frame of chassis is of specially light yet strong channel steel. The motor is immediately in front of the dashboard, fixed in a vertical position, 7 b.h.p., and embodies many special features. Transmission is by means of the simple and most satisfactory cardan shaft, through three speeds forward and reverse, change speed gear box, top speed driving direct.

The speeds are changed by means of a sliding movement of gear wheels, operated by *one lever only* for the four gears. The cardan shaft conveys the power from gear box to back axle by means of the well-known and most successful bevel gearing, a steel pinion driving the large phosphor bronze wheel fitted to differential box. The high tension system of electric ignition is used.



CHASSIS OF LIGHT CAR BY ALLDAYS AND ONIONS PNEUMATIC ENGINEERING CO., LTD.

RUNNING-SHED NOTES.

BY J. C. R. ADAMS.

II.

A LARGE and increasing proportion of the engines now built are fitted with cylindrical or bored out guides; but in cases where two or four slide-bars are used it becomes necessary to carefully examine the guiding flanges of the cross-head blocks to make sure that they are not too tightly fitted sideways, in which case, owing to the rapid motion of the cross-head, heating and cutting or abrasion would immediately set in. It is better to err on the side of safety and allow a little side-play. Particular attention should be paid to seeing that the lubrication is directed to the bars upon which the pressure of the cross-head, due to the angularity of the connecting rod, comes; that is, of course, the upper pair of bars if the engine be running "inwards", and the lower pairs of bars, if it be running "outwards." Cast-iron bars and blocks, made from the same metal, if lubricated properly, soon acquire a hard polished surface, and need no means of adjustment if the wearing surfaces are large enough to begin with.

It goes without saying that the guide bars must be accurately in line with the bore of the cylinder, and that both must point exactly to the centre of the crank-pin. The axis of the crank-shaft also must be truly at right angles with the centre line of the engine. To check the direction of the axis of the cylinder the cover is removed, and a thin flat steel bar, is fitted diametrically across the bore of the cylinder at each end. One of these bars carries a V-shaped notch, and the other a V-shaped projecting point exactly like the sights of a gun. The line of sight should, of course cut the exact centre of the crank-pin. Having thus ascertained that the bore of the cylinder is accurate in direction, the centrality of the piston-rod hole, of the stuffing-box, and of the cross-head hole (or socket in which the piston-rod fits) may be demonstrated in like manner by fitting a little sight-bar into each successively. If the cross-head while being moved back and forth in its guide bars, deviates neither to the right hand nor to the left, the engine may be considered true, so far.

The crank, which has been all this time, set with its throw-journal, or crank-pin, furthest from the cylinder, is now turned through half a revolution. If the centre of the pin still remains in the line of sight, it may be taken that the squareness of the main bearings with respect to the axis of the engine is established. But the truth of the crank-throw journal, or crank-pin itself remains to be proved. For this we shall require the connecting-rod. This being put in place with its large end cottered on the crank-pin but with its small end free, will show us, on the crank being rotated, according as the free end travels in a straight line or otherwise, whether the crank-pin is perfectly true, with its axis of the crank-shaft or not.

Having passed satisfactorily all these tests the engine is now ready for steam. For the ordinary four hours' tests under full load the engine's own flywheel is utilised as a brake pulley, although the rim would soon get uncomfortably hot if encircled by the ordinary brake, for more than a very few minutes. As a matter of practice once the engine has shown its capability of lifting the prescribed brake-load, and the indicator cards have been taken, the brake is removed, and a long lever with a brake-block resting upon a fulcrum, giving about a four-to-one leverage, is put under the flywheel and loaded at the long end to a sufficient extent to give roughly the required resistance. The advantage of this is that the flywheel rim, for the greater part of its circumference is exposed to the cooling action of the atmosphere. Of course, in any test for steam consumption, or where it is necessary to measure the brake horse-power developed for any length of time the flywheel is taken off and a special wheel with deep flanges on the inner circumference of the rim substituted. A water supply is fixed up delivering into this rim, and a small spout is placed so as to meet the rotation, and so, as it were, peel or turn off the solid body of water which revolves in and with the rim of the wheel as fast as it comes in.

ENGINEER'S BOOK OF THE WEEK.

"MACHINE TOOLS AND WORKSHOP PRACTICE."

THIS useful publication deals with a branch of engineering in which new developments are constantly taking place, and the author may serve the purpose of keeping not only the student, for whose use it is primarily intended, but the busy professional man acquainted with the latest methods of workshop practice. One must keep abreast of new developments, and it is common knowledge that the number of machine tools is rapidly being added to with a consequent change in manufacturing methods, and sometimes, indeed, a radical departure from old systems.

It is true that in the columns of PAGE'S WEEKLY and other technical publications the improvements which are being effected in grinding and milling, and turret lathe work are being constantly dealt with, yet a text book which cements the information on any one subject is to be warmly welcomed. The main object of the book, as expressed in the title, is to explain the construction and use of machine tools in that connected form which long experience of practical work and teaching has proved to be the most suitable.

The most important chapters in the book are those dealing with measurement, turret lathes, grinding and milling, and these have been illustrated in detail. Exact measurement, always of the first importance, i becoming more than ever necessary in modern mechanical workshop practice, owing to the use of interchangeable parts in machine construction. Theoretically, of course absolute accuracy is impossible, and only the close approximation can be obtained, but seeing that the ordinary Whitworth machine measures $\frac{1}{1000}$ of a millimetre, and the electric micrometer small dimensions and magnitude of the order. $\frac{1}{1000000}$ of a millimetre we have at least reached a point in detecting error beyond the capacity of existing machines to correct, and may, therefore, rest content.

The author deals with turret lathes in a long and interesting chapter selecting for notice the Hartness Flat Die type, the Alfred Herbert Gisholt, Hexagon, the Brass Finishers' and Capstan lathe, and pointing out the advantages of these different machines for varying classes of work. Attention is properly directed, however, to the fact that success in the manufacture of machine tools demanding accuracy depends largely upon methods which will produce better work than the lathe; hence the necessity to finish the work by grinding with emery-wheels in a suitably designed machine. It is obvious, indeed, that the introduction of hardened spindles, bearings, etc., into lathes, milling and other machines, is only made possible by the introduction of suitable grinding machinery, and all engineers realise not only the improvement in the quality and durability of the work thus brought about, but what is of equal, perhaps of even greater importance in these days of strenuous competition, the great saving thus effected in the cost of production. As a matter of experience, some materials, such as soft steel, can be worked to much better advantage by grinding than with the lathe. A satisfactory emery-wheel is a very important factor in the production of good work, but only a good variety of shapes, sizes, and grades of wheels, illustrated in the book, can be trusted to bring out the full possibilities of grinding machinery.

The illustration shows a Universal lapping and grinding machine. The principle on which this machine depends in the lapping out of holes in the use of a series of eccentric spindles. The inner one carrying the grinding wheel is somewhat less in diameter than the hole to be ground, and revolves at a high velocity. This grinding wheel is brought into contact with the surface of the hole to be ground by adjusting the orbit (in which it revolves and which orbit revolves) to the necessary extent, which is accomplished by increasing the eccentricity of the spindles by means of the band wheel, shown in the illustration on fig. 8. These movements are combined with an adjustable vertical reciprocating motion of the whole system of spindles, actuated by the crank-rod and levers (figs. 10, 11 and 12) for the purpose of traversing holes of various depths. The eccentric orbit is adjusted centrally with the hole by means of the transverse adjustment on the head stock (fig. 13) and longitudinal

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Machine Tools and Workshop Practice," by Alfred Parr, with an introduction by William Robinson, M.E., M.Inst.C.E. With 500 illustrations. Longmans, Green and Co. 10s. 6d. net.

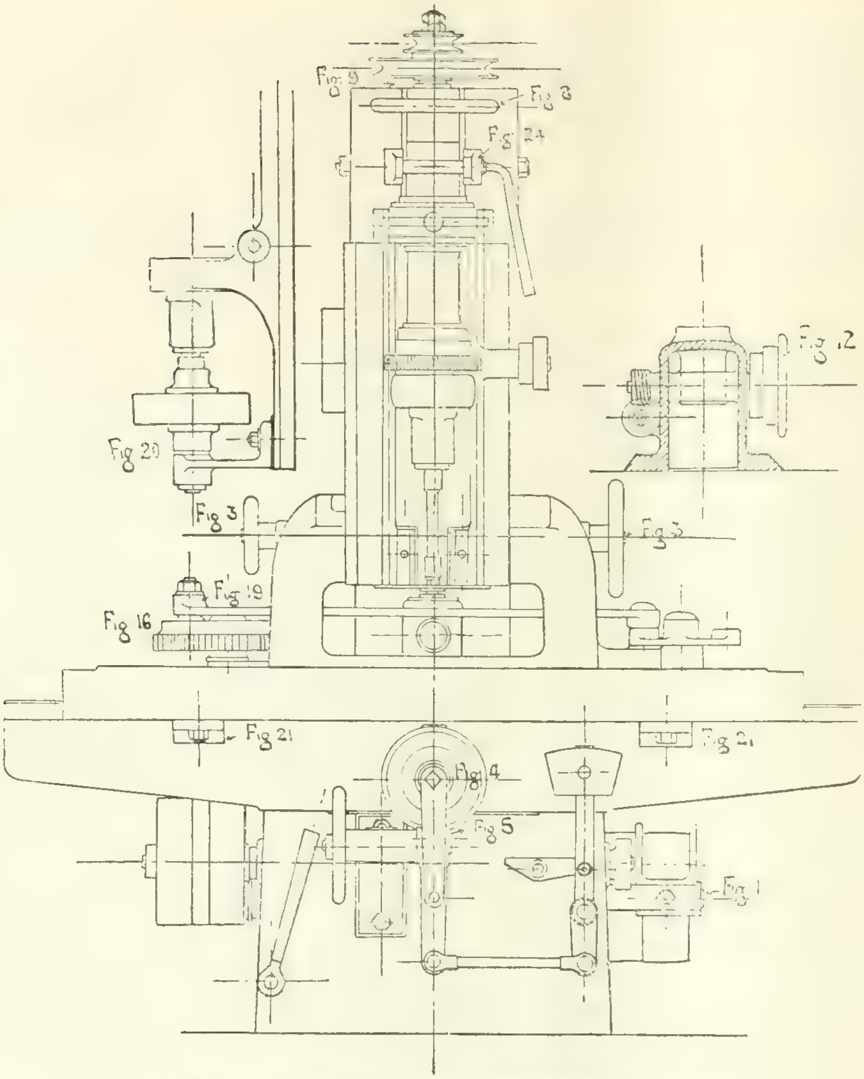

FIG. I. UNIVERSAL LAPPING AND GRINDING MACHINE.

adjustment on the main table (fig. 4), this table having a fine adjustment with worm and wheel (fig. 5) which is actuated by a clutch (fig. 6). The correct position is found by inserting the grinding wheel in the hole and revolving the main spindle (fig. 7). The feed is obtained by carefully measuring the eccentricity of the grinder spindle by turning the hand-wheel (fig. 8) at the top of the main spindle which is then fixed in position by the lock-nut (fig. 9). The emery-wheel can be raised by lifting the connecting rod (fig. 10).

The milling machine is not, of course by any means modern, but it was not until comparatively recently, as readers will remember, that it has become universally adopted as an absolute necessity in all branches of engine construction and machine building trades. The chapter on this subject is copiously illustrated, and will well repay the reader's study. The remainder of the subject matter is arranged under the head of gearing and gear cutters, filing and erecting, vice-work and tool forging processes, and hydraulic machine tools and the final chapters deal lucidly with transmission of power and methods of working. A good index adds to the value of the work the compilation of which must have demanded no little skill in the selection of material. To write a comparatively small book on so large a subject and yet to have included so much, is a task on which the author may look back with satisfaction.

OUR COLONIAL RAILWAYS.

SIERRA LEONE, LAGOS, AND THE GOLD COAST.

THE present position of railway enterprise in British West Africa is summed up in a report drawn up by Messrs. Shelford and Son,* consulting engineers, and included in a return recently presented to Parliament.

An expedition which left England on October 25th, 1893, for the purpose of making a preliminary survey was the first active step taken towards the construction of railways in Sierra Leone. The survey comprised an examination of the route from Freetown *via* Hastings, Waterloo, Songo Town, Rokelle, to Bumban, a distance of some 120 miles from Freetown, the route being that followed by Major Festing during his expedition in 1888 and proposed by him for a railway.

The same party also examined a scheme for a light railway in the Sherbro district from Bonthe to Mina, and thence to Sembahun, near the Liberian frontier.

From the former survey it was evident that a line from Freetown to Songo Town would form a trunk line for all railways in the colony, in whatever direction they might eventually spread over the interior. This portion, 32 miles in length, was accordingly authorised in September, 1895, and construction was commenced in March, 1896. A gauge of 2 ft. 6 in. was adopted for reasons of economy in spanning the numerous ravines traversing the route of the railway.

With regard to extensions from Songo Town, the result of Governor Sir Frederick Cardew's journeys through the colony in the years 1894 and 1895 showed that a more productive country would be tapped by a line to the south of that to Bumban, and upon his recommendations the further surveys of the line were undertaken in an easterly direction *via* Rotifunk, Mano, Bo, and Baiima, towards the Liberian frontier. The extensions have been since carried out in sections step by step, the route finally selected being that shown upon the accompanying map (page 292), accurately as far as Bo, and approximately to Baiima.

The following statement gives the date of the report upon each extension of the main line, together with the dates of commencement and completion of each section.

Section	Distance in Miles	Reported upon under Date	Construction		Remarks.
			Begun.	Finished.	
Freetown—Songo Town	32	13 Aug. 1894	Mar. 1896	Dec. 1898	Difficult country. Eleven large viaducts
Songo Town—Rotifunk	23	22 Nov. 1897	June 1899	Mar. 1900	
Rotifunk—Bo	80	21 Dec. 1899	Dec. 1900	Oct. 1902	
Bo—Baiima	87	28 July 1902	Feb. 1903	—	In progress. 51½ miles completed in February, 1904
Total	222				

SIERRA LEONE MOUNTAIN RAILWAY.

A suggestion has been made during the administration of Major Nathan, R.E., that residences for officials should be placed upon the salubrious heights above Freetown instead of in the low, unhealthy town at the foot of the hill, and as a result the construction of this line as a steam adhesive railway was authorised in August, 1902. This important local railway is now completed, the opening having taken place on March 1st, 1904. It starts from the terminal station of the main line in Freetown, and, though the length is not great, the difficulties were considerable, there being a large quantity of excavation in hard syenite and laterite, and much work to be done in the streets of Freetown, which are not well adapted to the laying of a railway. The gauge is the same as that of the Sierra Leone Government Railway, viz., 2 ft. 6 in. The gradients are steep, being 1 in 23 for a large proportion of the route. One of the locomotives, by the Hunslet Engine Company, used on this line, is shown in the illustration on page 295.

LAGOS.

In the year 1893 Sir Gilbert Carter, then Governor of Lagos, made an interesting and important journey through the "hinterland" of Lagos, leaving Ebute Metta on January 3rd, 1893, and returning to Lagos on April 4th, having visited Otta, Ifo, Itori, Abeokuta, Eruwa, Iseyin, Oyo, Ogbomosho, Ilorin, Ikerun, Ilesha, Oshogbo, Ede, Iwo, Ibadan,

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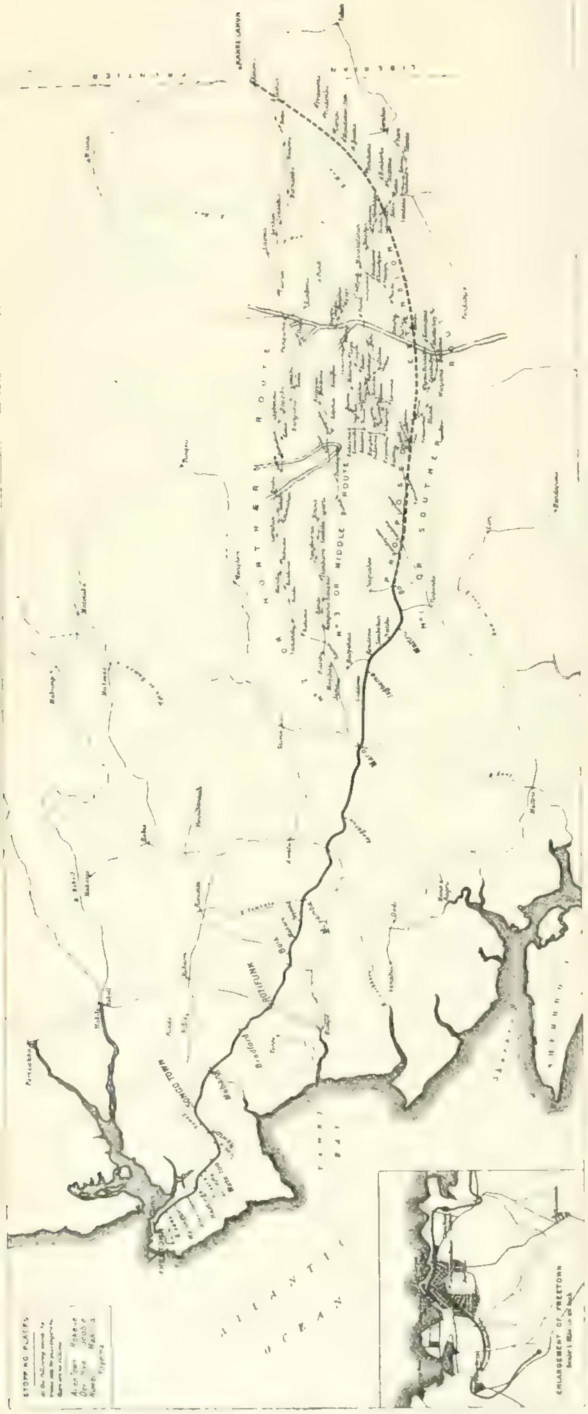
* Since the date of the report, Sir William Shelford, K.C.M.G., has retired from the firm of Shelford and Son, and the business of the firm has been carried out by Sir Benjamin Baker, K.C.B., K.C.M.G., LL.D., F.R.S., D.Sc. (Past President of the Institution of Civil Engineers) and Mr. Frederic Shelford, B.Sc., M.Inst.C.E., under the style of "Baker and Shelford."



MAP OF THE SIERRA LEONE TRUNK LINE.

Jebu Ode, Shagomo, and Ikorodu. The main object of this mission was political, but during the expedition Sir Gilbert Carter paid special attention to the question of railway construction, and eventually stated that there was ample room for encouragement in the prospect of a railway into the heart of the Yoruba country, and he felt sure that such a project should be proceeded with.

As a result of this expedition Mr. W. Shelford, M.Inst.C.E., was instructed to carry out during the dry season of 1894-5 a survey for a railway by alternative routes, and a reconnaissance of the following routes was accordingly made: (1) Lagos to Ilaro *via* Otta; (2) Ilaro to Abeokuta; (2A) Otta to Owowo; (3) Abeokuta to Ibadan; (4) Jebu Ode to Ibadan; (5) Epe to Jebu Ode; (5A) Ejirin to Jebu Ode; (6) Ikorodu to Shagomo. The gauge of railway adopted is that of 3 ft. 6 in., which is in use in South Africa, Australia, and upon the Soudan Military Railway, and can almost be called the Standard Colonial Gauge.

The dates of the authorisation, commencement and completion of the line from Lagos to Otta and subsequent extensions are given below, the railway being constructed *via* routes 1 (part), 2A, 2, and 3 mentioned above.

Section.	Distance Miles.	Date Authorised.	Construction Begun.	Construction Finished.	Remarks.
Lagos–Otta	[illegible]	Dec., 1895	Mar. 6, 1896	Sept., 1896	Considerable interruptions due to [illegible] operations
Otta–Abeokuta	44	Dec., 1896	[illegible], 1897	Ap[illegible]	
Abeokuta–Ibadan	61	24 June 1898	May, 1899	Dec., 1900	
Total	125				

The Lagos railway works include the construction of the Denton Railway Bridge from Iddo Island to the main land, it having been decided to place the terminus of the railway upon the Island of Iddo, to which there is a better navigable channel for steamers through the Lagoon than to the main land. A map of the railway is shown on page [illegible].

CARTER-DENTON ROAD BRIDGES.

It was decided in September, 1895, before the railway was authorised, to construct a road bridge from the island of Lagos across the tidal lagoon to Iddo Island. This is called the "Carter Road Bridge." It is 2,[illegible] ft. in length and is carried on screw piles over [illegible] ft. long. The strong reversing currents, depth of mud and running sand through which the piles had to be driven to obtain a foundation added to the difficulties of the work. A road across Iddo Island leads to another shorter bridge stretching from Iddo Island to the main land, thus completing the communication. This is called the "Denton Road Bridge" and is 917 ft. in length.

The Carter-Denton Road Bridges have no connection with the railway, which was not authorised until December, 1895. They were promoted by Sir Gilbert Carter, former Governor of the Colony, with a view of affording a much-needed means of communication between Lagos Island and Iddo Island, and thence to the main land for foot passengers, horsemen, and vehicles. The need for the Carter and Denton Road Bridges is demonstrated by the fact that an average of no less than 50,000 persons cross between the island and the main land in a single week, of whom as yet but a small percentage continue their journey upon the railway. The public are sometimes inclined to consider the bridges as a part of the railway, and to include their cost in the cost of the railway. This is an error, as the bridges actually compete with the railway to some extent. Communication between the railway terminus and the town of Lagos is established by means of a 2-ft. 6-in. steam tramway which crosses the Carter Bridge and runs to the doors of the traders' stores in Lagos.

THE GOLD COAST.

The construction of a railway from Sekondi to Tarkwa was commenced early in 1898, but owing to objections to the selection of Sekondi as the port which were pressed very strongly upon the Government, work was suspended until the Secretary of State in July, 1898, held a conference at the Colonial Office with those interested, at which it was decided to adhere to the original proposals, and the actual period occupied in the construction, after the decision that Sekondi was to be the starting point, was 34 months, during which a base with landing jetties, staff quarters, workshops, running sheds, carriage sheds, turntable, etc., was established at Sekondi, a place formerly consisting of a few mud huts, difficult of access, and with no accommodation whatever. This work was carried out in the face of three wet seasons, a prolonged scarcity of labour, and, finally, the Ashanti war.

The Tarkwa-Kumasi extension was authorised on a route which for the first 60 miles or thereabouts was diverted from that which Mr. Fred. Shelford had examined in order that it might serve the Wassau, Abosso, Cinnamon Bippo and other mines, and was begun in June, 1901. The rails reached Obuassi (86 miles) on December 20th, 1902, and Kumasi (128 miles) on September 30th, 1903. The erection of permanent bridges and completion of ballasting were finished to Kumasi on March 31st, 1904, upon which date the completed railway was transferred to the Open Lines Department.

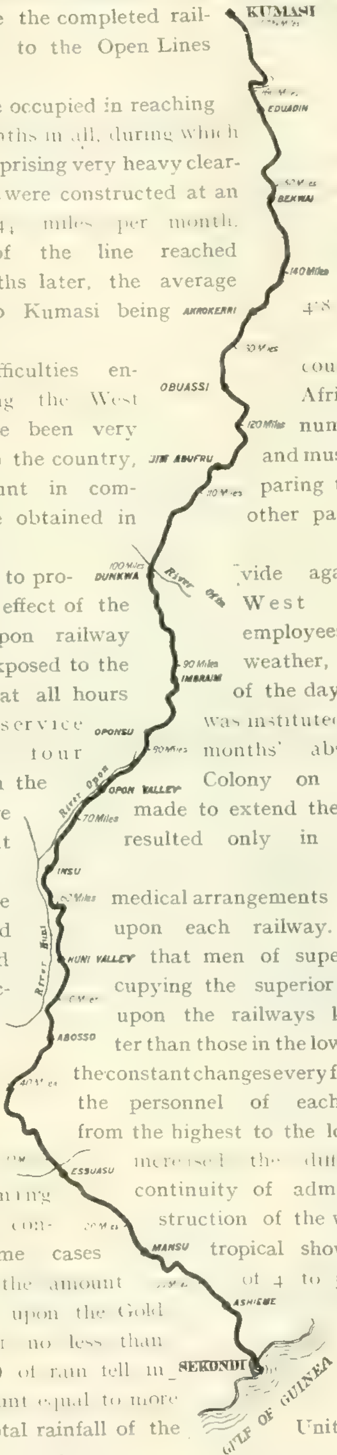
The time occupied in reaching Obuassi was 18 months in all, during which 86 miles of line comprising very heavy clearing and earthworks were constructed at an average rate of 4¾ miles per month. The extension of the line reached Kumasi nine months later, the average rate from Tarkwa to Kumasi being 4·8 miles per month.

The difficulties encountered in constructing the West African railways have been very numerous and peculiar to the country, and must be taken into account in comparing the results with those obtained in other parts of the world.

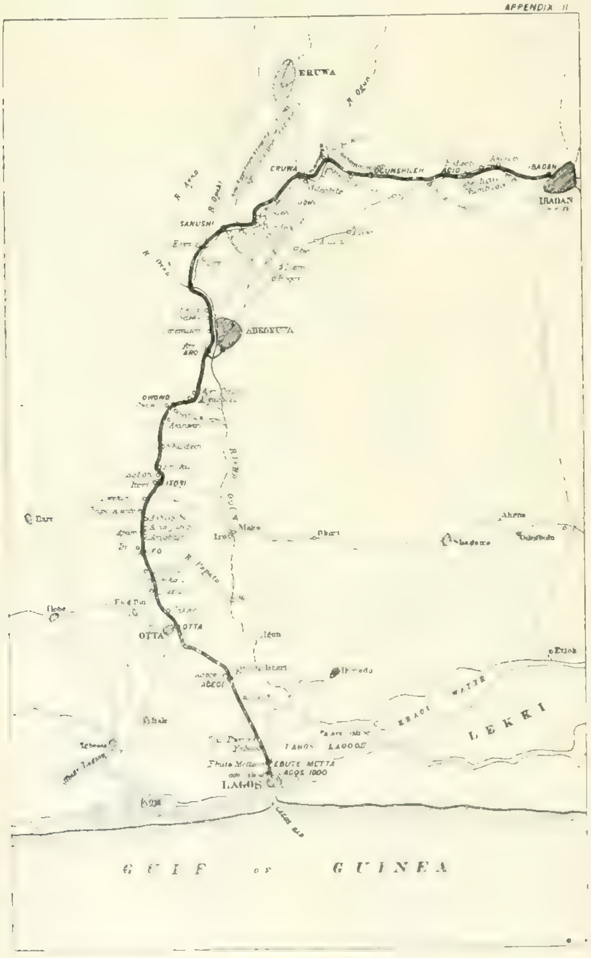
In order to provide against the disastrous effect of the West African climate upon railway employees who are specially exposed to the weather, both heat and rain, at all hours of the day, an eight months' service was instituted, carrying with it four months' absence on leave from the Colony on half-pay. Efforts were made to extend the period of service, but resulted only in increased sickness.

Elaborate medical arrangements have been organised upon each railway. It has been found that men of superior education occupying the superior appointments upon the railways keep their health better than those in the lower grades, but the constant changes every few months in the personnel of each appointment, from the highest to the lowest, has greatly increased the difficulty of maintaining continuity of administration in the construction of the works.

In some cases tropical showers have fallen to the amount of 4 to 5 in. at a time and upon the Gold Coast in June, 1901, no less than 30 inches (2 ft. 6 in.) of rain fell in the month—an amount equal to more than the average total rainfall of the United Kingdom in one year.



This has added greatly to the difficulties of construction. At Sierra Leone, owing to the occurrence of laterite, the difficulty has been little felt; but at Lagos, owing to the alluvial nature of the soil in the neighbourhood of the Lagos lagoons, not a single hard stone the size of a marble could be found until over 50 miles from the coast; consequently all the ballast, amounting to over 2,000 tons per mile, had to be railed from near Abeokuta. Upon the Gold Coast the difficulty has been even greater, as ballast has been essential to the road which traverses a country subject to heavy rainfall, densely forested, and with a soft clay soil. Rock or gravel, however, was reported as very difficult to find in convenient positions near the railway and where it could be economically extracted. Hard rock does not often occur at a less depth than 50 to 100 ft., as is shown by some mining shafts, and such a depth is of course prohibitive for ballast purposes. It was necessary to adopt the expedient of collecting boulders from the bush, by contract with the natives, and breaking them up for ballast. The total amount required for the Gold Coast Railway amounted to some 500,000 tons, and considerable absorption has taken place owing to the necessity for pushing the permanent way over new banks before they had been more or less consolidated by a season's rainfall.



THE LAGOS-IBADAN RAILWAY.

SHIPPING AND LANDING DIFFICULTIES.

Over-carriage of materials, damage to the same, and the loss of ships carrying large consignments of railway materials, have added greatly to the difficulty of providing the materials in proper time and order, especially as it has only been possible to ship small quantities in each steamer in order not to congest the wharves and piers available, or to hamper the shipping company's landing arrangements.

At Sierra Leone the wharf accommodation is extremely limited, though the harbour is otherwise good. At Lagos it is necessary to tranship all cargo at Forcados, some 150 miles beyond Lagos, into branch boats, which return and cross the Lagos Bar. On the Gold Coast at Sekondi all materials have had to be discharged into surf boats and lighters in the open roadstead. The lighterage is in the hands of Messrs. Elder, Dempster and Co., and small consignments have been necessary to prevent delay to the steamers or congestion of the lighterage plant.

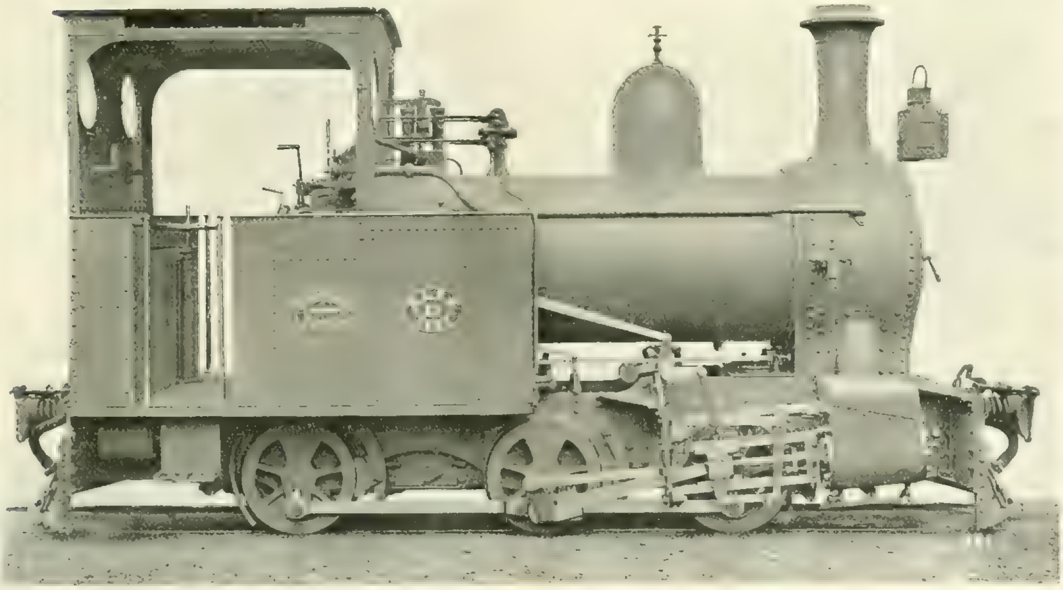
It should be understood that none of the railways have been undertaken as a whole, the work having been carried out in each case tentatively by sections, an interval frequently occurring between the completion of one section and the authorisation of the next, and in all cases the authorisation of the work by sections has rendered impossible an organisation suitable for the rapid construction of the whole. This cautious policy has no doubt been the wisest for each colony to adopt, but has been detrimental to an ever-increasing rate of progress, which would have been realised if from 120 to 220 miles of railway had been undertaken at a time.

The influences militating against rapid progress of railway construction in West Africa are, the want of landing facilities, sickness of staff, and absence of continuity of control due to climate, excessive rainfall, and the physical obstruction of the dense tropical forest rendering survey very slow and requiring heavy labour in clearing, and by the necessity for carrying on the entire work and conveying all the materials from one base.

COST OF CONSTRUCTION.

In considering the cost of the construction of railways in West Africa it is necessary to recollect that they have been carried through dense tropical forest in what is generally recognised as the worst climate in the world, necessitating very short tours of service and constant changes of staff in every grade; with very heavy rainfall; with scarcity and inferiority of unskilled labour and the complete absence of skilled labour; with considerable landing difficulties; and the necessity of carrying on construction entirely from one base owing to absence of road or path of any description to facilitate the transport of materials in advance of railhead. Further allowance must be made for the native revolts and military operations which have occurred in each case, causing interruptions and disorganisation. The table on page 206 shows the cost of the British West African Government Railways compared with other railways in Africa and in British Possessions.

From these details it will be seen that railways aggregating 522 miles in length have been successfully constructed in the face of the difficulties enumerated, and in the cases of Lagos and Gold Coast with scarcity of ballasting materials.



ONE OF THREE ENGINES SUPPLIED FOR WORKING THE TRAFFIC ON THE SIERRA LEONE MOUNTAIN RAILWAY, WEST AFRICA.

The engines were designed by Messrs. Baker and Shelford, Westminster, engineers for the railway, and constructed by the Hunslet Engine Company, Ltd., Leeds. The cylinders are 9½ in. diameter by 12-in stroke, the coupled wheels 2 ft. diameter, and the wheel-base 7 ft. 6 in. The outside "Walschaerts" valve gear is controlled by reversing gear. The boiler is of steel, with copper fire-box and brass tubes, the total heating-surface being 220 square feet, while the fire-grate area is 4½ square feet. A double spark-arrester is fitted to the smokebox. As it was desirable to keep down the weight of engine and provide only sufficient for one journey, the tank capacity is only of 140 gallons. The working steam-pressure is 160 lb. per square inch, and the engine is fully equipped with modern fittings. It has "Combination" injectors, steam and hand brakes, and vacuum brake for the train, 4 sandboxes, a double-roofed cab, cowcatcher, and the standard central buffers of the Sierra Leone Railways. The weight in working order is 11 tons 11 cwts., equally distributed on the six coupled wheels, and the empty weight is 9 tons 10 cwts.

COST OF THE BRITISH WEST AFRICAN RAILWAYS

Including Permanent [illegible]

—	Gauge	Total cost	Length	Cost per mile	—
Sierra Leone —		£	Miles	£	
1st section	[illegible]	[illegible]	32	6,0[illegible]	Includes establishment of [illegible]
2nd section	[illegible]	[illegible]	[illegible]	4,224	Impeded by native insurrection.
3rd section	[illegible]	[illegible]41	[illegible]	[illegible]	Including permanent steel [illegible]
4th section	[illegible]	[illegible]	[illegible]7	4,[illegible]	[illegible] expected.
Total and average	[illegible]	[illegible]15	222	4,31[illegible]	
Gold Coast	[illegible]	1,7[illegible],488	170	10,314*	According to [illegible] complete at date [illegible] expected. Expenditure upon jetties, piers, seawalls and other harbour works is not included.
Lagos	[illegible]	882,[illegible]61	125	7,064	Includes [illegible]

---

* The higher cost of the Gold Coast Railway is due to the difficulties referred to in the text, the heavier works [illegible] and the high rate of wages [illegible] in connection with the mining companies.

† The expenditure upon the Lagos Railway as shown, does not include the cost of the Carter and Denton Bridges, Lagos Steam Tramway and other works carried out by the Railway Department.

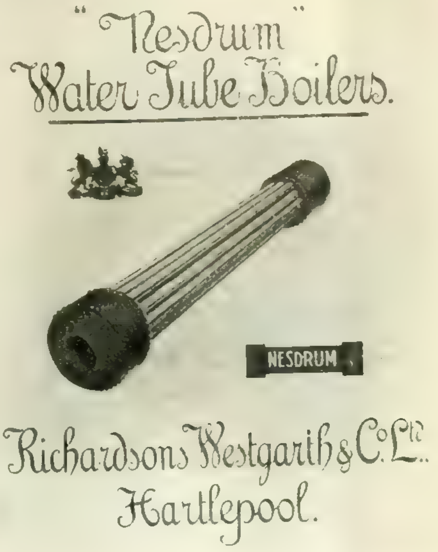
The following table shows the actual rate of progress of each railway:—

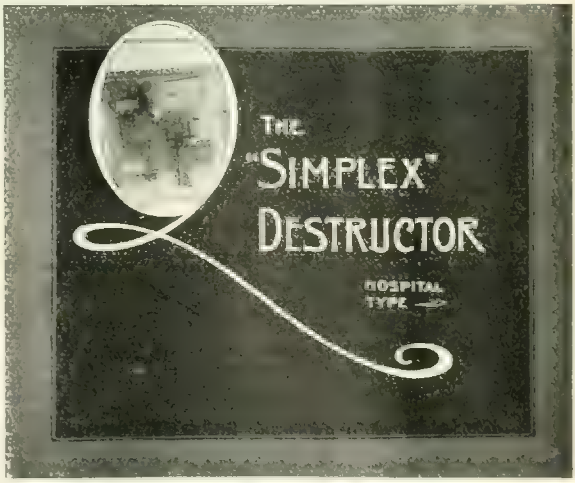
Section	Length Miles	Begun	Finished	Time in Months	Average Rate in Miles per Month	Remarks
Sierra Leone Railway (2 ft. 6 in. gauge) —						
Freetown—Songo Town	32	Mar. 1896	Dec. 1898	[illegible]	1	Includes construction of headquarters and establishment of base. Difficult country eleven steel viaducts. Interruption due to native insurrection.
Songo Town — Rotifunk	23	June 1899	Mar. 1900	9	2·6	Mendi rising delayed commencement.
Rotifunk—Bo	[illegible]	Dec. 19[illegible]	Oct. 1902	22	3·6	Rail laying at rate of five miles per month during part of time.
Bo—Baiima	[illegible]	Feb. 1903	Nov. 1904	21	4·1	Progress at date of report is as expected.
	222			85	2·6	Average including construction of base.
Lagos Railway (3 ft. 6 in. gauge) —						
Lagos—Otta	[illegible]	Mar. [illegible]	Sept. 1897	[illegible]	[illegible]	Includes construction of headquarters and bridge from island to main land.
Otta—Abeokuta	44	Oct. 189[illegible]	April 1899	1[illegible]	[illegible]	Delayed by military operations.
Abeokuta—Ibadan	61	Mar. [illegible]	Dec. [illegible]	[illegible]	[illegible]	Includes terminal work at Ibadan.
	12[illegible]			52	2·3	Average including preliminary work at base.
Gold Coast Railway (3 ft. 6 in. gauge) —						
Sekondi—Tarkwa	[illegible]	Aug. [illegible]	May [illegible]	[illegible]	[illegible]	Includes construction of headquarters and pier. Delayed by scarcity of labour, Ashanti war and heavy rains.
Tarkwa—Obuasi	[illegible]	[illegible]	Dec. [illegible]	[illegible]		Rail laying reached twelve miles per month. Heavy public traffic carried upon railway during construction.
Obuasi—Kumassi	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	1[illegible]			[illegible]	[illegible]	Average including establishment of new base at Sekondi. N.B.—Very dense forest all along throughout.

The rate of construction compares favourably with other railways in tropical Africa, with the sole exception of the Uganda Railway, which had the advantage of being authorised and organised as a whole and not in tentative sections.

CATALOGUE COVER DESIGN.

Messrs. Richardsons, Westgarth and Co., Ltd., of Hartlepool, have designed for their "Nesdrum" Water-Tube Boiler Catalogue a cover which is significant and at the same time pleasing to the eye. The type and nest of tubes are embossed, the latter being rendered in grey and gold, while vermilion, on a rose-pink background, is employed for the script lettering. The pamphlet is tied with a red silk cord.





The lower design shows the simple yet effective arrangement of the cover chosen by Messrs. Meldrum Brothers, Ltd., for their new pamphlet on "The Simplex Destructor of the hospital type."

MINING NOTES.

Mining Records.

The output of coal in Queensland for [illegible] amounted to [illegible] tons valued at £[illegible], being the largest yet recorded with the exception of [illegible], when the figures were [illegible] tons value £[illegible].

Statistics issued by the German Iron and Steel Institute show that last year's production of pig iron was the highest on record, the output of all classes amounting to [illegible] tons as compared with [illegible] tons in 1903. Coal, lignite, coke and briquettes showed a large increase over 1903, the former advancing from [illegible] tons in 1903 to [illegible] tons in 1904,

The twentieth United States Geological Surveys annual report on the mineral resources of the country, containing the statistics for the year 1903, is now available, and shows that the total value of their mineral production exceeded $1,000,000,000. The exact figures were $[illegible] as compared with $[illegible] in 1902, a gain of [illegible] per cent. The value of American iron ore in 1903 was $[illegible], the value of the coal, $503,724,381.

Goid Mining in Peru.

The mineral wealth of Peru has frequently been the subject of comment in Page's Weekly. In a recent number of the Mining Magazine, Mr. Enrique Lavoza calls attention to the wide distribution of gold in that country. As to the hydraulic method of mining with giants and sluices, which have been so much employed, he says that the most important of the new installations is that of San Antonio de Poto, which in 1903 produced an output of 222,169 lb. In the near future, the hydraulic method will probably convert this neighbourhood into one of the world's principal centres of production. The sands of all the rivers of the eastern slope of the Cordillera carry gold in enormous quantities. During the period of low water, the natives are accustomed to pave the dry river beds with stones; during the high water the rivers cover these stones, depositing particles of gold in the interstices, and when the period of low water returns the Indians collect many ounces of gold nuggets. The production obtained by this rudimentary method in 1903 reached 631·008 lb. troy.

Mica Production.

Though mica is an exceedingly widely distributed mineral, the occurrences of commercial value are exceptional. Out of seven varieties three only have a commercial value, their relative importance being that of the order in which they are named—Muscovite or potash-alumina-mica, Phlogopite or magnesia-mica, and Biotite or iron-magnesia-alumina-mica. Different varieties of Muscovite are distinguished by their colour, and are as follows: ruby, obtained from Bengal, Nellore, the Nilgris, and Brazil; brown obtained from German East Africa; yellow, obtained from Bengal; green, obtained from Nellore, German East Africa, and Brazil; and white obtained from Bengal. Phlogopite is obtained from India, Ceylon, Canada and Brazil. Mica occurs in veins and ordinary mining methods are employed in working it; overhead stoping however, is advocated, as in this case the mica is recovered undamaged by wet. The imports into this country in 1902 were 1,068 tons, and in the succeeding year [illegible] tons, with an average value of £[illegible] and £87 per ton respectively, while the United States for the same years took 878 and 802 tons.

Endless Rope Haulage in India.

The last annual report of the Chief Inspector of Mines in India, states that endless rope haulage is installed at three colleries, viz., (1) at Warora, in the Central Provinces; (2) at Jamadoba, in the Jherria coal-field; (3) at Raniganj. At Warora the tubs are hauled up an incline to the pit bottom only, and are taken up the pit in cages. At Jamadoba the tubs are hauled right up two of the main inclines to the surface and on to the screens. This installation is quite new, and it will be interesting to see how it compares with the usual main rope haulage out of inclines, (1) with regard to the comparative cost, and (2) with regard to the comparative amount of coal which can be raised at one incline per day. It is possible that the endless rope may prove to be the best method of dealing with a large output from one incline. The endless ropes haul out of the side levels as well as up the inclines, the branch being worked off the main rope by clutch gearing. And there are also two landings or attaching points in the No. 4 incline. The tubs are attached to the ropes by means of a simple and effective clip that automatically releases the tubs at the ends of the inclines. The inclination of the seam is 1 in 8, rope speed two miles an hour, and the plough steel wire ropes are 2½ in in circumference. The driving pulleys are the Thorncliffe clip type, 8 ft. diameter. In the inclines, self acting stop-blocks have been, or are being, fixed at intervals of 50 ft. to arrest any runaway full tub that has from any cause become detached from the ropes.

OUR WEEKLY BIOGRAPHY.

PROFESSOR WILLIAM ROBINSON, M.I.Mech.E., M.Inst.C.E., etc.

PROFESSOR W. ROBINSON, chief of the mechanical and electrical engineering department of the University College of Nottingham, was born at Burt, near Londonderry, December 28th, 1858. He was educated at the Academical Institution, Londonderry, at the Magee College, Derry, and in 1876 he matriculated at Queen's College, Belfast. After two years of study in the Faculté des Sciences, University of Geneva, he completed the three years' course in civil and mechanical engineering at Belfast.

In 1881 he graduated as Bachelor of Engineering, civil and mechanical. At this degree examination he secured first place in the Queen's University of Ireland in the engineering subjects, and also in mathematical physics, chemistry, geology and mineralogy. He was awarded first-class honours, with the gold medal and first Peel prize, and subsequently the senate of the university conferred upon him the honorary degree of Master in Engineering.

After graduation, Mr. Robinson was engaged in practical engineering work in Ireland. In 1882 he became assistant to Professor Perry, in London. Before the City and Guilds of London Technical College, Finsbury, was opened in 1883, he was appointed chief assistant in the department of Mechanical Engineering and applied Mathematics. At the end of about two years he resigned his post for the purpose of gaining more experience in practical engineering, and again entered the service of Professors Ayrton and Perry, who, at that time, were carrying on a large practice as consulting and manufacturing engineers. During 1886, with the same object in view, he was engaged by Messrs. Latimer-Clark, Forde, and Taylor, where he had experience in the manufacture, testing, and laying of submarine telegraphic cables. He went on the West African cable-laying expedition, and assisted in the supervision of the laying of various sections, landing and testing the cable after its completion.

In January, 1887, Mr. Robinson returned to the staff of the City and Guilds of London Technical College as senior demonstrator and lecturer under Professor Silvanus P. Thompson, in the Department of Electrical Engineering and Applied Physics.

In July, 1890, he was appointed to the position he now holds as professor of engineering at the University College, Nottingham. He has charge of all the engineering classes of the College, and has arranged systematic courses of instruction in the workshops, laboratories, and drawing office.

In 1890 Professor Robinson published "Gas and Petroleum Engines"—a well-known text-book on the internal combustion engine. He was amongst the first to see in the modern form of petroleum oil engine a handy self-contained and economical prime mover. In 1891 he was awarded a silver medal by the Society of Arts for his lecture giving some of the results of his early researches on the "Uses of Petroleum in Prime Movers"; and at the Society's request he delivered a course of Cantor lectures on the same subject early in 1892. Professor Robinson has devoted special attention to the development of different types of the internal combustion engine, and has tested and reported on many gas and oil engines, petrol engines for motor-cars, gas producers, steam boilers, dynamos, and electric light and power installations. He is often consulted on special questions concerning internal combustion motors by engineers in England, Europe and America.

Professor W. Robinson is a member of the Institution of Civil Engineers, a member of the Institution of Mechanical Engineers, a member of the Institution of Electrical Engineers, and a Fellow of the Physical Society of London.

PROFESSOR WILLIAM ROBINSON, M.I.MECH.E., M.INST.C.E., ETC.

Sir William Preece on the Navigation of the Nile.

THE Nile has been very much in evidence lately, but we have heard a great deal about irrigation and very little about navigation. Mr. William Preece has brought his experience of fifty years to bear upon this important aspect of the Nile question, and his conclusions were stated in the course of a valuable paper contributed last week to the Society of Arts.

Sir William dealt principally with the question of the navigation of the Nile from Assouan to the sea, that is, the regulation of its currents, depth of water, channels, and banks, so that the motion of its boats shall be possible in all times and seasons both up and down stream. The Nile, he says, is virtually embanked from Assouan to the sea. It is practically a canal, and should be treated as a canal. The following paragraphs briefly summarise his views:—

> The chief point for careful consideration appears to me to be not only the control of the water, but the control of the silt. Thirty thousand tons of valuable mud are lost in the sea every year, and the rise of the bed of the river in the Delta is a very serious question. Navigation is thus checked, but the remedy is at hand. The outlets are to be cleared by dredging. More sediment will be utilised on the land. Currents will be regulated by storage and barrage. Floods will be under better management. But what is most urgently needed is the protection of the banks, the training of the river, its maintenance in well defined limits, a depth navigable in all seasons, and a call on Nature to assist man to regulate this precious water communication for his daily service.
>
> The principal problem to be solved is how to secure that the Nile shall maintain its own current at a greater velocity than that which causes settlement and so maintain the depth of the river, and how to prevent the increase of this velocity so as to save the erosion of the banks. The Assouan dam has shown how to do it, and the Wadi Rayan appears to be an eligible depression to enable a second reservoir of the same storage capacity to be installed. It is a matter under discussion, and serious objections, geological and financial, have been urged against its adoption, but let us hope that these objections will disappear under careful scrutiny and survey, for no more eligible position could possibly be secured for such a desirable scheme to supplement the Assouan reservoir, for it would reduce the evaporation difficulty to a minimum.

The works which Sir William considers necessary to improve the navigation of the Nile are thus detailed:—

> 1. The removal of obstructive banks and shoals. It has been found in the Severn that the removal of shoals (submerged banks) and deepening the bed of the river by dredging has led to a marked increase in the flood discharging power of the river. The navigation has also been greatly improved.
>
> 2. The river banks in certain places where they are subject to erosion want to be well pitched to prevent this erosion, and to maintain the proper direction of the current. An admirable system of pitching is to be seen near the landing stage as Asyût.
>
> 3. Quays want to be built at all towns where commerce is active, goods are landed, and passengers embark and disembark.
>
> 4. Shadûfs and Sakias require to be abolished, especially the former.
>
> 5. Training walls are needed to direct currents in useful directions. The following conclusion was adopted by the Seventh International Congress of Navigation at Washington in 1898:—
>
> "The increase of depth effected by dredging, combined with the rectification of the banks, may, under certain circumstances in the condition of the régime of a river, furnish a satisfactory solution, as shown by the results obtained upon the Severn in England."
>
> 6. New lands want to be developed by the deposit of the silt and by the dredging of the river on reclaimed banks and places.

A word as to ways and means:—

> The number of boats of all classes plying exceed 22,000. The owners of 22,000 boats would surely submit to a small taxation of £1 per boat per annum to secure better information than they have now, and some attempt at buoying, marking, and beaconing channels.

The Underground Electric Railway Company's Power Station at Lot's Road, Chelsea.

IN a former article we described the new power station at Lot's Road, then in an early stage of construction. By the courtesy of the British Westinghouse Company we are now able to present our readers with views of the completed station, and equipment. It is destined to supply energy for working the whole District Railway system, and also the Baker Street and Waterloo, the Great Northern and Brompton, the Charing Cross and Hampstead, and the Edgware and Hampstead lines. These, in total, amount to over sixty-three miles of track, of which the District Railway supplies about forty, and will unitedly represent by far the heaviest and densest traffic of any electric line. The now practically completed power house contains 60,000 h.p. of generating machinery, covers over 3½ acres of land, including yards, etc., and has cost some two and a half millions of money. The site upon which it stands measures on the water frontage 1,100 ft., and on the Lot's Road side 824 ft.

The size of the building and the plant that it contains have involved the greatest care in laying the foundations, which consist of about 220 concrete piers sunk through strata of made ground, gravel, and sand, to the London clay at a depth of 35 ft.

At the eastern extremity of the site a large barge basin is situated, the function of which is to dock the barges conveying coal or other material to the works. Behind this is the oil cooling plant, and on the western extremity of the site a large bin for containing the furnace ashes before shipment. In the construction of the buildings little less than 20,000 tons of steel have been used, of which some 6,000 tons have gone to the main framework.

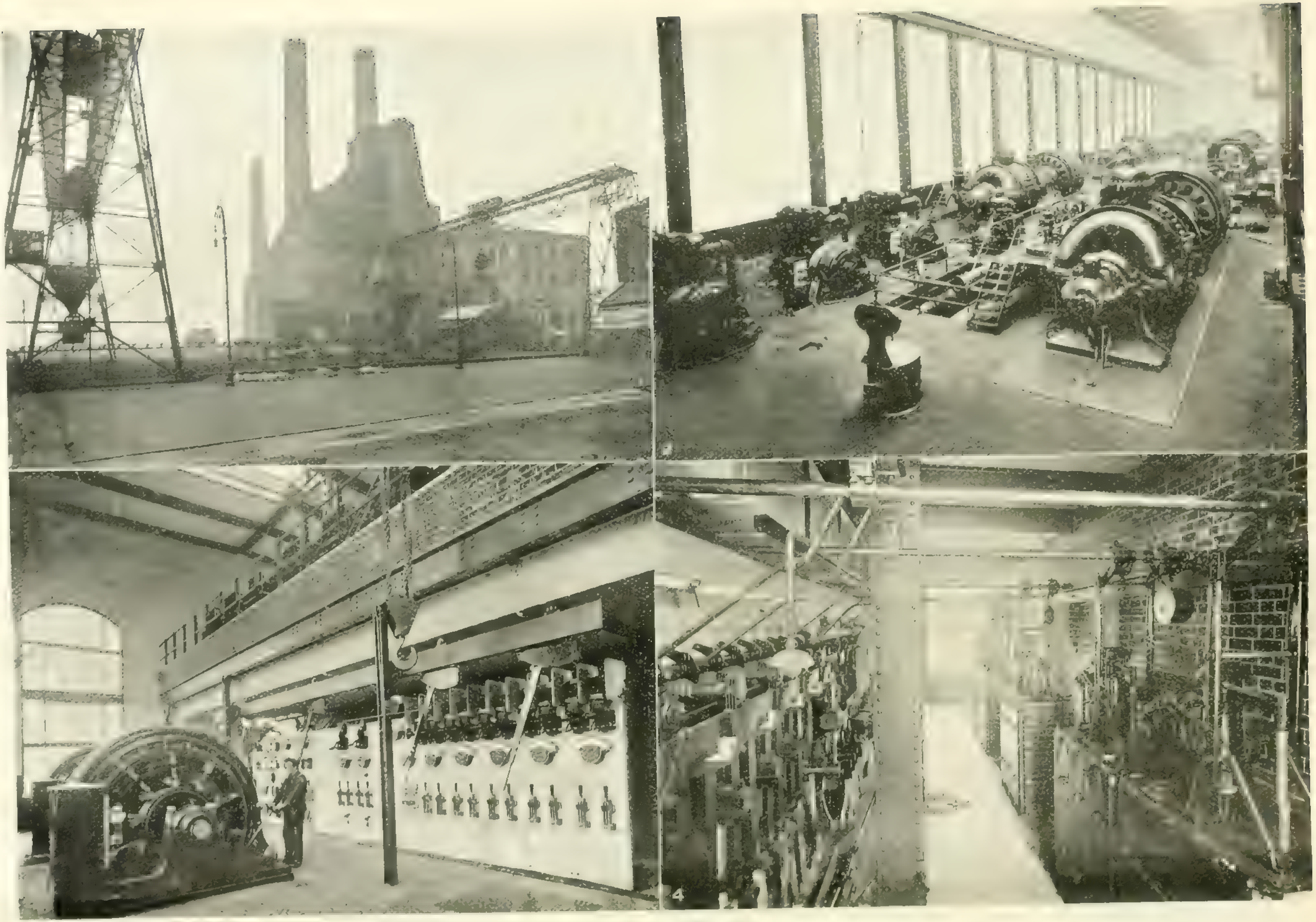
The chimneys, of which there are four, are built on the Custodis principle, with an internal diameter at the base of 19 ft., and a height of 275 ft., and are placed symmetrically, in pairs, in the boiler-house section, about a quarter of the length of the building from the ends.

The internal arrangements of the building, which measures 453½ ft. long by 175 ft. broad and 140 ft. high, are shown in cross-section, fig. 5. The coal bunkers are situated on the top floor, the capacity of which is 15,000 tons. As the boilers will consume some 800 tons of fuel daily when the station is in full working order, it is obvious that such a capacity is necessary. The coal is picked up from the barges by two one-ton grab-travelling cranes, and after being weighed is carried by belt and inclined conveyors to the top of the building. Here it is deposited upon another belt conveyor, which is so arranged as to effect its distribution to the several bunkers in any desired quantity. As an alternative to water-borne coal, arrangements have been made to obtain the supply of fuel from sidings of the West London Extension Railway by further arrangements that bring the coal in at the opposite end of the bunkers.

The ashes from the fires are dealt with by self-dumping buckets running on rails laid under the ash hoppers on the ground floor. A storage battery locomotive hauls these to the barges, where they are unloaded by pneumatic hoists. Compressed air is used for sundry purposes, including the operation of the barge basin gate machinery, capstans, and sundry large valves in the power-house.

The boiler-house contains sixty-four Babcock and Wilcox water-tube boilers supported directly on the steel framework of the building, and space is left for the installation of sixteen more. Each possesses 5,212 square feet of heating surface, and is provided with a superheater of 672 square feet area. They are divided up into sets of eight, the number required to operate each turbine unit at full load. There is no steam connection between the various groups, except in one case, where a header for supplying steam to the auxiliaries is fed from two of them. Chain grate stoking gear is provided, with 83 square feet of surface for each boiler. Economisers with 10 ft. tubes are grouped behind the boilers with a by-pass flue, and the total pipe area installed allows 1,540 square feet of feed water heating surface per boiler.

The main steam piping runs down the boiler-house



THE UNDERGROUND ELECTRIC RAILWAY COMPANY'S POWER EQUIPMENT.

(1) —Exterior View. (2) —The Engine Room. (3) —Interior of typical Sub-Station. (4) Oil Switches, etc., at Hounslow.

side of the dividing wall and under the engine-room floor to the turbines, and is supplied with the usual valves and water pockets.

In the engine-room are installed eight Westinghouse steam turbine generating sets, each consisting of a turbine of some 7,300 b.h.p., coupled direct to a three-phase alternator of 5,500 kilowatts output. The former are of the Westinghouse single cylinder, double flow type, and are designed to run with a steam pressure of 165 lb. per square inch, a superheat of 100 deg. F., and at a speed of 1 000 revolutions per minute. They are capable of sustaining an overload of 50 per cent. by aid of automatic by-passes, and are extremely economical in steam consumption.

The three-phase Westinghouse alternators are of the revolving field type and on a non-inductive load will supply a current of 289 amperes per phase at a pressure of 11.000 volts. They are of 5,500 kilowatts capacity, with a frequency of 33·3 per second. The revolving field is a solid forging of Whitworth fluid-pressed steel, of good permeability, and is wound in the usual manner. The armature core of laminated iron is supported by a heavy cast-iron frame, divided horizontally, and is wound in slots on its inner surface.

The four exciter units consist of an Allen-British-Thomson-Houston combinationf and have a capacity of 125 kilowatts at 125 volts when running at 375 revolutions per minute.

The condensers are on the dry vacuum principle, with separate motor-driven air and water pumps. They are installed in pits between the two rows of turbines and have each 15 000 square feet of cooling surface which is fed with circulating water, conveyed through 66-in. pipes from the Thames. The cooling system is based on the principle of the syphon and the 20 in. centrifugal pumps have simply to overcome the friction in these pipes. The condensing equipment was supplied by Messrs. J. H. Simpson and Co.

The switch gear is arranged on three galleries placed principally across the north side of the engine-room. It was supplied by the British Thomson-Houston Company and all the high tension switches are motor-operated by means of a low-pressure circuit controlled from a small pilot switchboard.

The main were supplied by the British Insulated and Helsby Cables, Ltd., and are laid in Doulton stoneware ducts. There are twenty-four substations on the line to each of which a duplicate feeder is run; sixty-four ducts have therefore been laid, which allow for some extension. The feeders are carried through the streets to the Earl's Court station of the District Railway, which is the nearest point to Lot's Road.

The substations of the Metropolitan District Railway supply direct current to the southern half of the Inner Circle, and to a very wide area extending from East Ham to Hounslow and from Sudbury to Wimbledon and Richmond. These points form approximately the bounds of the Company, and are all primarily supplied with power from Lot's Road.

The contract for the whole of the District Railway substations was awarded to the British Westinghouse Company, who are responsible for the design, manufacture and installation of all the buildings and plant.

The British Association.

The South African meeting of the British Association opens on August 15th, the President-elect being Professor G. H. Darwin, F.R.S. Among the presidents-elect of the various sections are: Mathematical and Physical Science: Professor A. R. Forsyth, M.A., Sc.D., F.R.S.; Chemistry: T. Beilby; Geology: Professor H. A. Miers, M.A., D.Sc., F.R.S.; Engineering: Colonel Sir Colin Scott-Moncrieff, G.C.S.L., K.C.M.G., R.E. Lectures have been already arranged by Professor Arnold, on "Compounds of Steel"; Professor Ayrton, on "Distribution of Power"; Professor Porter, on "Mining"; Mr. G. W. Lamplugh, on "The Geology of the Victoria Falls"; and Sir William Crookes, on "Diamonds."

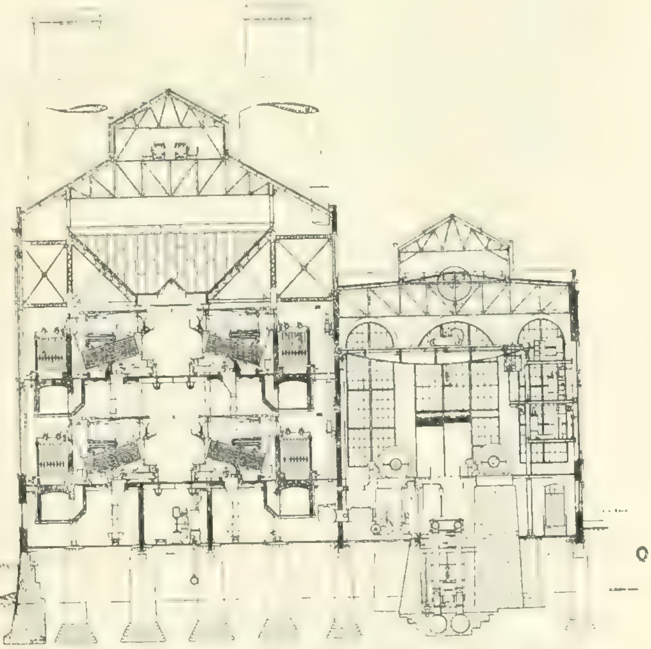
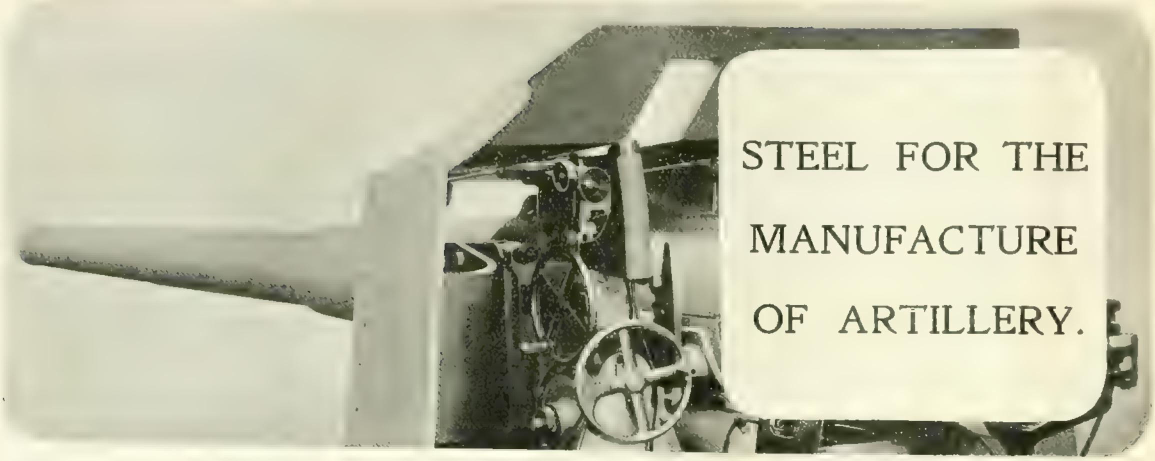


FIG. 5. LOT'S ROAD POWER STATION —CROSS SECTION



STEEL FOR THE MANUFACTURE OF ARTILLERY.

By Colonel Cubillo (Spanish Royal Artillery).

THE WATERTOWN ARSENAL.

(*Continued from page* 235.)

THIS arsenal, dedicated to the construction of carriages for army artillery is situated in the environs of Boston. The same abundance of space as at Watervliet is observed.

There are foundries and mechanics' shops, and, apart from them, the famous Emery testing machine. The not very spacious foundry possesses a reverberatory furnace for the fusion of the coast defence carriage-pieces. In one of the mechanics' shops are placed vertical boring and turning Niles Company mills and other machines for the finishing of large pieces. The disappearing carriage for the 40-centimetre gun having been adopted, the Watertown Arsenal has begun their construction on the plans prepared by Generals Buffington and Crozier, of the Ordnance Corps. Some attention has been paid to the forging of bronze; the experiments started years ago, having been continued during 1902 with good results, and it is proposed to carry them on until the problem has been solved.

An interesting experiment has been made with thin slices cut from a hollow-hardened piece to discover if their initial tensions could be considered as an exact representation of those of the whole piece. The conclusions arrived at are as follows: 1. The cut slices represent the condition of the metal in the whole piece as regards the internal tensions, and, approximately, their magnitude. 2. The metal in the centre shows an initial compression greater than that indicated by the slice. In the tests this difference was 2·1 kilogrammes per square millimetre. 3. Longitudinal compressions occurred in the centre; they were approximately 75 per cent. of the tangential tensions. 4. The extremities of the tubes, owing to the effect of the longitudinal compressions, took a bell-shaped form. 5. The condition of the metal in the centre of the extremities is less exposed to longitudinal tensions. 6. The run-over concludes with the internal tensions of all kinds. 7. The tension disappeared at 600 deg. centigrade; at 450 deg. half only disappeared. 8. The disappearance of the tension is effected without producing deformations in the pieces.

The Watertown Arsenal has constructed the following carriages during the past year:—

		c/m.
1	Disappearing Carriage of	30·5
3	" " ..	20·0
1	" Barbette " .	30·5
6	Howitzer " ..	30·5
1	" " ..	25·0
22	" " ..	18·0

Including the Platforms.

As will be seen, the production is not large, and is not sufficient to mount the guns made at Watervliet, but Midvale constructs what is lacking for coast defence, and the arsenal at Rook Island completes those for field-pieces.

This writer was not permitted to visit the last mentioned place, but it is one of the most important in the United States; as important, if not more, than Watervliet; it employs more workmen, and is not confined to one class of manufacture: harness for artillery, cavalry, and infantry, small arms and rifles being made. The factory turns out 225 rifles daily. In a word, it produces all the materials required by a soldier in time of peace or war.

SPRINGFIELD.

The Springfield small arm factory is situated at Springfield, Massachusets, and presents the same external characteristics as the other national establishments—ample space, well-kept parks, and superb edifices.

The series of reheating furnaces merit special mention. The factory receives the rifle barrels incompletely rolled; they come from Midvale in bundles of about 30 centimetres in length, and are then rolled to the length required at Springfield.

There is nothing out of the ordinary to chronicle regarding the machine work on the barrels, but the excellence of the machines employed, chiefly supplied by Pratt and Whitney. The stocks are made by copying lathes similar to the Blanchard.

A powerful Corliss engine supplies the motive power to the workshops of this section.

At the time of the writer's visit the Springfield factory was preparing for the construction of the new rifle adopted by the United States Government. This rifle, calibre ·30 or 7·6 millimetres, possesses the following ballistic qualities: Weight of ball 14·25 grammes; weight of charge 2·80 grammes; initial velocity 701 metres; velocity at 915 metres, 292 metres; muzzle energy, 362 kilogrametres. The magazine holds five cartridges. Total weight, 450 grammes less than the rifle in use at present.

Springfield turns out two hundred rifles daily, but as this production is not great enough to arm the whole of the army, National Guards and volunteers, in a short time, new workshops are being added to those in existence with the intention of doubling the output. If the 225 rifles per day manufactured by Rook Island are added to this number, the United States Government will be able to count upon 625 per day of eight working hours.

One of the most curious experiments at Springfield has been with a rifle invented by Dr. Cole. The section of the barrel is elliptical 0·30 in. by 0·31 in., and the inclination of the rifling is one turn in 185 millimetres. This rifle was found to be of greater precision than the one in use at distances above 300 metres, The officers on the Committee made further experiments, and then came to the conclusion that the greater precision was not due to the elliptical shape of the barrel, but owing to the inclination of the rifling.

Springfield, like Watervliet and Watertown, takes great care of its workmen, and spends large sums in the prevention of accidents. The wealth of America is manifested in the military factories, in the workshops, the machinery, the offices, and in the appearance of the workmen.

PROFESSOR HENRY ADAMS.

Professor Henry Adams, M.Inst.C.E., etc., who recently retired from the City of London College, has been appointed by the President of the Board of Education to be a member of the Board of Examiners at South Kensington in the engineering group of subjects, and he will act as co-adjutor with Mr. Slater, F.R.I.B.A., in dealing with the subject of building construction. Professor Adams has been for some time examiner to the Society of Architects in building construction and materials, and chairman of the examination committee, superintending examiner to the Institute of Sanitary Engineers, and a member of the Board of Examiners of the Royal Sanitary Institute.

BRITISH COAL.

POSSIBLE ECONOMIES IN PRODUCTION AND USE.

(From the Report of the Royal Commission on Coal Supplies.)

II.

THE MANUFACTURE OF COKE.

IN this industry by far the most important step in recent times is recognised by the Commission to be the introduction of by-product recovery ovens. Whether it will pay to work the by-product recovery process depends first on the nitrogen in the coal recoverable in the form of ammonia, and, secondly, on the volatile matter in the coal recoverable as tar and oils. According to the evidence, 16 or 17 per cent. of volatile matter in the coal probably represents the paying minimum worth of recovery.

In dealing with a coal which is so poor that it will not pay to recover the by-products, a "non-recovery retort oven," is, according to the evidence, the more economical. The yield of coke is good and the ovens are of simpler construction.

It used to be, and sometimes is still, claimed that the old-fashioned Beehive ovens give the hardest, brightest and best coke. The prejudice in their favour is, however, disappearing, and it is beyond question that these ovens are most wasteful, the yield of coke being at least 10 per cent. less than in the case of retort ovens.

The production of coke, as it is extensively carried on in this country, without full utilisaton of the volatile products, was condemned by all the witnesses. In the best modern practice these products are either burnt in flues round the ovens, or are separated by cooling into liquids and gases, the latter of which are used for heating the ovens themselves. The surplus gas can be used for the production of power under steam boilers, or with greater advantage in gas engines. Coke oven gas is a rich gas, approximating to illuminating, and far richer than producer, gas.

Various methods are now adopted for the improvement of the coke from poorer class coals, and also for the coking of coals hitherto regarded as non-coking. The most important of these methods are washing and compression, which have made it possible to coke many coals previously considered useless for coking. Compression has the effect of increasing the output and gives a better and stronger coke. Coal which will not coke in a Beehive oven will frequently do so in a retort oven, and excellent results are obtained from the admixture of a fat or rich coal with a poorer coal. The addition of 5 or 10 per cent. of pitch has also been found to be effective in quick ovens but this method is too costly for common use.

The importance of the extended adoption of coking, continues the report, cannot be exaggerated. It is one of the methods by which small coal can be rendered marketable. and in some districts it has reduced the waste by furnishing the collieries with an outlet for the small coal, without which outlet it is doubtful whether they could have been carried on.

MANUFACTURE OF BRIQUETTES.

Hitherto this industry has been mainly confined to South Wales, where the small coal made in the screening and in the transit of the best steam coal, is mixed with 8 to 10 per cent. of pitch and converted into briquettes. Large quantities of similar small steam coal are exported to the Continent for the same purpose. Of the value of these briquettes as fuel there is no doubt, and they are extensively purchased by the Royal Navy as a reserve stock in hot climates, where they are said to deteriorate less than Welsh coal. In England and Scotland briquettes are seldom made, probably because there is a good market for small coal. There is, however, every reason to anticipate that in the future, they will be more largely used for steam and domestic purposes, and there appears to be a good field for the discovery of a suitable binding material; pitch, which is the chief binder at present being rather too smoky for domestic purposes, and also high in price.

The evidence points to the conclusion that a suitable briquette plant, if well managed, should pay in connection with a colliery; at present the briquette factories in this country are mostly situated at, or near docks. Suggestions have been made that partial distillation, in addition to washing and cleaning, would give a much wider choice of material for the manufacture of first-class briquettes, and that coal and oil might be used in combination so as to form briquettes of good calorific value out of inferior coal.

Summing up this section of the evidence the Commissioners opine that seams which cannot now be worked at a profit, will in the future be rendered profitable by washing, sorting, coking, briquetting the coal, or converting it into gas, and that no small coal need be left in the mine. It has been proved that large quantities of the best Welsh steam coal are left underground in the form of "small," solely because under present conditions it does not pay to bring it out. It appears that much of this "small," although it is frequently dirty, is of similar quality to that now made into briquettes in South Wales, and we look to washing and briquetting as one of the available methods by which such coal can be brought out and sold to advantage.

ECONOMIES IN TRANSPORT FROM THE COLLIERIES TO THE USERS THROUGHOUT THE UNITED KINGDOM.

A few witnesses suggested that the rates charged in some districts for the carriage of coal are unreasonable. Whether that be so or not, the Commissioners will not attempt to say without a full inquiry into the circumstances, but the opinion of other witnesses was that the railway rates in this country generally were not unreasonable having regard to all conditions.

It was suggested that the use of larger wagons and engines would effect a saving both to the Railway Companies and to the colliery owners, but it was admitted that large wagons would not be applicable to the whole coal trade, and in many cases would involve costly alterations in the pit-head arrangements Even if these suggestions were carried out it does not follow that there would be any material reduction in the cost of transport.

The evidence points to a future extension of central power stations, and the generation and transmission of power upon a large scale. If such stations were established in close proximity to the collieries, there would be nothing to pay on the coal in the way of railway rates, and the question would then be, not the cost of the transport of coal but the cost of transmission of power.

Canals are but little used in this country for the conveyance of coal. The evidence shows that this is partly due to shortness of water and partly because the railways afford a more direct, rapid and convenient means of transport. The Aire and Calder Canal has, however proved of great advantage to the Yorkshire coalowners, especially for their shipping trade, and on the Continent in recent years great developments of the canal systems have been undertaken with a view to affording cheap water carriage.

ECONOMIES IN USE.

Coming to the vastly important subject of economies in use, the Commissioners draw particular attention to Mr. Beilby's interesting calculation that out of an annual consumption of from 143,000,000 to 168,000,000 tons of coal in this country there is a possible saving of from 40 to 60 million tons. How these economies may be effected, and the difficulties standing in the way of their extensive adoption, are indicated under several heads, the first being concerned with the production of power.

COAL WASTED IN STEAM RAISING.

Mr. Beilby has estimated that about 52 million tons of coal are annually converted into steam power at mines and factories in the United Kingdom, and it is generally agreed that the consumption of coal per i.h.p. per hour is on an average about 5 lb. When it is stated that the consumption of coal per i.h.p. per hour should not exceed 2 lb., and might even be less, the waste and extravagance of our methods of raising steam will be realised. It is true that improvements and economies have been going on, especially during the last twenty-five years, and according to the evidence there is now very little hope of improvement upon the best type of modern steam engines; but it is said that if all steam engines were as efficient as the best, 50 per cent. of the coal now used for steam raising might be saved. The use of oil and gas engines is increasing, but for greater economy we must look to the general installation of central power stations.

It is beyond question that collieries are extremely wasteful in the consumption of coal, and it was stated by one witness that if the whole of the plant of the collieries in the kingdom were modern plant of the best description, the consumption of coal would be one half of what it is to-day.

FURTHER SUGGESTED ECONOMIES.

The witnesses stated that a more extended use of economisers, automatic stokers, and mechanical draught is desirable for greater economy and a careful and systematic analysis of chimney gases and of the ashes from the furnace was advocated. Important results have been obtained by superheating the steam on its way to the cylinder and economies can be effected by the extended use of exhaust steam for heating purposes.

Considerable waste now goes on through boiler incrustations, owing to the use of hard water for raising steam. Mr. Maurice Deacon stated that an incrustation from half to three-quarters of an inch thick caused a loss of 20 per cent. in power. He strongly advocated the use of water chemically purified, but especially the use of condensers as the most economical and effectual manner of producing good boiler water.

The Hon. C. A. Parsons stated in evidence that steamers fitted with turbines give superior speed and less coal consumption for the same speed. There seems to be no limit to their size, but with a small power, say under 200 h.p., they cannot be worked so economically.

	Tons of Coal remaining unworked in Seams of Coal which are				Total Estimated Quantity of Coal remaining unworked	Estimated Quantity not capable of being worked due to Barriers required to be left or for support of Surface Buildings, &c.				Loss in Working due to faults and other natural causes in Seams of				Total Estimated Deductions due to all the foregoing causes	Estimated net available Tons remaining unworked
	Inches 12 to 15	Inches 15 to 18	Inches 18 to 24	Inches 24 and upward		Inches 12 to 15	Inches 15 to 18	Inches 18 to 24	Inches. 24 and upwards	Inches 12 to 15	Inches 15 to 18	Inches 18 to 24	Inches 24 and upwards		
	Tons	Ton	Tons	Tons	Tons	Tons	Tons	Tons.	Tons.	Tons	Tons	Tons	Tons	Tons	Tons
DISTRICT A															
South Wales & Monmouthshire	1,479,304,119	1,671,742,890	2,960,164,500	27,031,798,830	33,143,000,339	84,079,665	115,509,504	175,726,518	1,562,704,977	224,976,416	228,491,934	483,830,497	1,096,684,249	6,972,003,760	26,470,996,579
Somersetshire and part of Gloucestershire								No details							4,198,301,099
Forest of Dean	29,529,125	64,064,225	66,173,275	146,161,512	305,928,137	1,290,749	1,635,147	2,236,875	3,533,710	3,043,424	6,624,484	7,163,852	21,866,449	47,394,690	258,533,447
DISTRICT B															
Stafford (N.)	9,196,402	43,051,632	167,083,818	5,048,501,222	5,267,833,074	332,095	2,121,987	8,632,801	362,264,291	757,640	3,368,439	13,163,642	509,141,832	899,782,727	4,368,050,347
Stafford (S.)	18,972,029	72,617,293	72,760,936	1,789,277,177	1,953,627,435	3,873,550	8,182,239	9,737,197	112,386,911	8,552,943	15,621,967	14,571,289	365,253,276	538,179,363	1,415,448,072
Warwick	10,690,111	16,132,837	14,279,289	1,407,702,319	1,448,804,556	430,245	829,486	1,016,657	62,684,315	1,836,957	2,814,503	2,379,146	249,831,444	321,822,653	1,126,981,903
Leicester	42,446,584	55,856,676	99,887,118	2,269,412,827	2,467,583,205	1,082,609	1,262,588	1,562,907	81,001,111	12,748,521	15,812,046	34,791,691	493,863,181	642,124,654	1,825,458,551
Shropshire	12,617,826	26,873,408	21,180,006	308,503,380	369,174,620	—	1,064,050	1,175,439	8,966,388	841,785	2,076,034	3,109,599	30,947,626	48,180,921	320,993,699
DISTRICT C															
Lancashire	156,451,034	206,122,247	392,731,612	4,594,249,544	5,349,554,437	4,108,961	7,383,851	15,917,265	220,955,775	33,882,284	48,740,170	61,596,103	718,462,301	1,111,046,710	4,238,507,727
Cheshire	18,418,885	16,702,875	28,905,250	294,971,162	358,998,172	69,328	54,000	315,000	5,834,257	3,284,663	2,742,084	5,228,832	49,637,737	67,165,901	291,832,271
N. Wales	31,226,375	45,051,851	152,404,652	2,284,343,322	2,513,026,200	256,250	835,589	2,910,186	89,627,383	4,768,890	8,720,530	29,276,404	640,163,139	776,558,371	1,736,467,829
DISTRICT D															
Yorks								No details.							19,138,006,395
Derby & Notts								No details.							7,360,725,100
DISTRICT E															
Northumb'l'nd	186,630,600	257,371,255	549,590,786	6,046,755,486	7,040,348,127	18,752,273	21,462,257	34,154,555	279,078,418	18,758,141	25,055,028	59,349,161	1,074,112,623	1,530,722,486	5,509,625,641
Cumberland	24,160,123	6,455,500	177,466,398	1,980,556,809	2,188,938,830	192,150	301,425	1,842,578	21,019,139	2,347,030	1,004,880	39,879,527	594,643,296	661,230,025	1,527,708,805
Durham	260,121,398	201,823,989	659,553,337	5,486,201,898	6,607,700,522	13,480,542	16,193,235	85,729,432	653,448,709	19,423,167	15,517,141	43,901,632	458,590,318	1,336,584,176	5,271,116,346
DISTRICT F															
Scotland	1,908,725,991	1,758,264,440	2,503,443,245	16,089,333,985	21,259,767,661	192,943,128	214,030,846	267,238,228	1,792,717,841	261,492,960	238,771,945	359,137,030	2,252,979,327	5,579,311,305	15,681,456,356
DISTRICT G															
Ireland								No details							174,458,000
														Total	100,914,668,167

TOTAL AVAILABLE COAL RESOURCES OF THE PROVED COALFIELDS OF THE UNITED KINGDOM, NOT EXCEEDING 4,000 FEET IN DEPTH.

For many years a large amount of experimenting has been done with a view to the discovery of some process for burning fuel in the form of an impalpable powder—the idea being to feed the furnace with a blast of air and the fine powder, which will burn like sprayed oil or a gas jet. This process is reported to have found favour in Germany, and to have been largely used in Berlin.

The use of forced or induced draught furnaces is extending and the results obtained are said to be good. Large quantities of small and inferior fuel have thus been used, which otherwise must have been cast aside as useless.

Much has been done in the last twenty-five years, but from the foregoing facts it is clear that there are still immense economies capable of realisation in connection with the raising of steam.

BLAST FURNACE GAS.

In this country an enormous quantity of waste gas is made in blast furnaces, of which insufficient use is made at present. Some idea of the value of this source of power will be given, when it is stated that the estimated amount of waste gas is equivalent to 1,000 h.p. for every 100 tons of pig-iron made and that the estimated potential power of this waste gas, if it were utilised for power purposes, would displace and save 2 to 3 million tons of coal annually—on a moderate estimate. Most of the difficulties in making suitable engines and in purifying the gas seem now to have been overcome, and the initial cost of an installation is stated to be approximately the same as that of a good steam plant, but the evidence points to a great opportunity of utilising a source of power which has hitherto been practically wasted.

COKE OVEN GAS.

The value and waste of coke oven gas have already been referred to in connection with the manufacture of coke. It is difficult to estimate the amount of potential power from this source, but it has been calculated that, assuming that an oven is carbonising at the rate of 7 tons a day, the waste gas from such an oven would be equal to about 40 h.p. in a gas engine.

MANUFACTURE AND USE OF GAS FOR GAS ENGINES.

Gas engines are now established as the most economical of heat motors, and it is said that if the average steam engine and boiler installation of to-day, with its average consumption of 5 lb. of coal per h.p. hour, were entirely replaced by gas producers and gas engines the 52 million tons of coal, which it is estimated by Mr. Beilby are consumed for power purposes at mines and factories, would be reduced to 11 million tons. The possibility of this enormous economy seems to be established by the results of many trials by which it is proved that power can be generated by gas engines in almost any locality and on almost any scale with the consumption of 1 lb. of average slack per i.h.p. per hour. The general introduction of gas engines and the use of producer gas could not therefore fail to have an important effect upon our coal consumption.

PRODUCER GAS PLANTS.

According to the witnesses much economy of fuel results from the use of producer gas plants, but this depends on several conditions, especially their size and their load factor. The fullest economy is obtained in large plants of 4,000 h.p. and upwards with recovery of by-products, in which case the cost of the coal is balanced by the value of the by-products; without recovery of the by-products it does not pay to put down plant for bituminous coal of less than, say 100 h.p. It would be difficult to exaggerate the importance of the development of these gas-producing processes, which are said to have rendered practicable the utilisation of inferior coal, and have thus enormously increased the available resources of the country.

WATER GAS.

It is in evidence that water gas is a very convenient fuel, if it is possible to obtain an ample supply of suitable coke at a sufficiently moderate price. Compared with producer gas, it has from 2 to 2½ times the calorific power, and being practically undiluted with inert constituents, it can be distributed in smaller pipes.

POSSIBLE SUBSTITUTES FOR COAL.

Under this heading the Commissioners considered: (i.) alcohol; (ii.) natural gas; (iii.) oil; (iv.) water power; (v.) windmill power; and (vi.) peat. They are convinced that coal is our only reliable source of power, and that there is no real substitute. There are, however, some possible sources of power which may slightly relieve the demand for coal.

PRODUCTION AND TRANSMISSION OF POWER.

Before passing away from possible economies in power production, the Commissioners refer to the savings which the witnesses anticipate from the increase of central stations for the generation and production of power in bulk. The success already attained by such stations in America, on the Continent, and in the United Kingdom makes it appear probable that in towns the smaller consumers will in the future obtain a large proportion of their power in this way. It is also said that central power stations scattered over the country wherever a source of power is available, be it coal, water, peat, or waste gas, will attract to themselves large users of power.

For all purposes where it is necessary to transmit power over a distance, electricity is now rapidly coming into use, and it is estimated that the annual production of electricity in this country is already something between 500 and 600 million Board of Trade units. According to the evidence, with an ammonia recovery plant a unit of electricity can be produced at about ·13d. per kilowatt hour working with a gas engine, not including interest and rent, and hopes are entertained that the cost may be still further reduced even to ·10d.

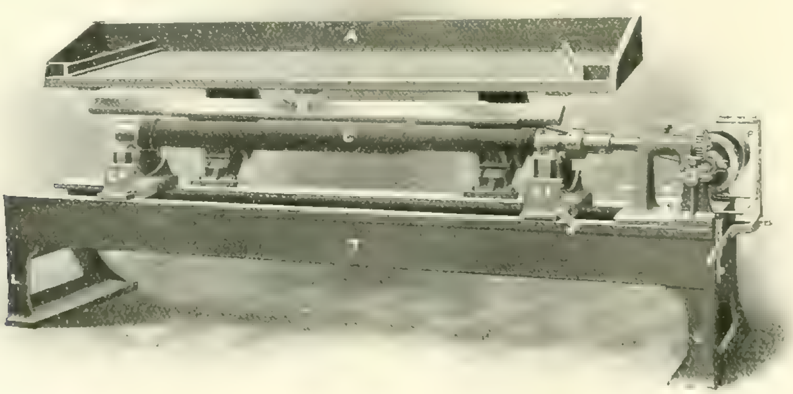
The Commissioners also deal with possible economies in the production of heat and light,

AN ADVANCE IN CORE-FORMING.

THE usual method of making cores for light pipes *i.e.*, rainwater, soil, or hotwater pipes, with metal ¼ in. to ⅜ in. thick is with hinged core boxes, the moulding sand being ground and prepared for the purpose. A square bar of iron runs through the full length to support the core when lifted from the core box to the mould; but it requires much skill and considerable practice, and the core when made is fragile and easily damaged. The method for heavy pipes, ½ in. to 1 in. thick, and 4 in. to 48 in. diameter, is to strike up the core with a board, first winding hay or wood wool rope round the core barrel (a tube running the full length of the core), and covering this with clay wash or loam, in which horse hair, etc., is used as a binding material. It is a slow, cumbrous and dirty operation, and the carting away of the residue accumulating under the loam boards is a source of waste and expense.

The machine illustrated herewith has been designed by Mr. W. Jones to make a better core in less time with unskilled labour, at half the cost, and it is suitable for thick or thin pipes from 2 in. to 20 in. diameter. It may be described as a core turning lathe, but instead of cutting metal off a revolving bar as in an ordinary lathe, the steel bar, about 11 ft. long, fixes (by its reciprocating motion) the sand on the core barrel as it revolves, thus making a perfectly true core with ordinary moulding sand, the thickness of the sand varying from ¼ in. thick on a 2 in. core barrel, to ¾ in. thick on a 12 in. core barrel.

The machine consists principally of the lathe bed, 13 ft. long, two adjustable carriages for carrying the core barrel, the headstock with driving spindle for revolving the core barrel, and a steel reciprocating bar shaped to suit the required core, which is driven by an eccentric from the main driving shaft. All the



THE JONES PATENT CORE-FORMING MACHINE.

A. Adjustable Shelf for carrying sand. B. Bar (steel reciprocating) shaped to suit straight, socket, taper or bell-mouth cores. C. Core on core-barrel. C 1. Collars same diameter as required core. C 2. Carriage with roller bearings, to carry core-barrel, adjusted vertically by means of rack and pinion. D. Driver (or sliding collar) for driving core-barrel. E. Eccentric. E 1. Eccentric rod. F. Fly wheel on main shaft. G. Gear (striking) for driving belt. H. Headstock. L. Legs to carry table casting. M Main shaft. M 1. Main shaft brackets. Pulleys (fast and loose) R. Rollers to carry reciprocating bar. R 1. Brackets for ditto. S. Saddle, with adjustable screw motion, carrying roller bracket and sand shelf. T. Table or bed. W. Worm gear, steel worm and wheel, machine cut and hardened.

parts are capable of quick and easy adjustment, the sand board for carrying the sand being placed above the reciprocating bar and core barrel. The bar is shaped to form the socket at one operation, and two, three, or four different diameters can thus be formed on one and the same core.

The machine is belt driven, requiring $\frac{1}{4}$ to $\frac{1}{2}$ h.p. only. The pulleys, 8 in. diameter, run 300 revolutions per minute, the reciprocating bar 300 strokes per minute. The core barrel revolves six revolutions per minute, being driven by worm gear.

The core barrel revolves on friction rollers, which are raised or lowered with rack and pinion to suit the varying diameters, the sand board and reciprocating bar are also adjusted with screw motions to suit any diameter of core, the adjustment from one core to another occupies about two to three minutes, parallel or taper cores being made with equal facility.

We are informed that cores of any length from 10 in. to 10 ft. can be made at the rate of twenty to forty per hour, and the cost for labour about $\frac{1}{2}$d. to 1d. per core, suitable for pipes cast on flat, or inclined beds, or vertically in pits. Sand and water only are required for ordinary cores, no hay or wood wool rope being required, but for brass tubes, or for heavy cast tubes to be cast vertically, a special facing is used, to prevent the metal from cutting away the sand. The waste pipe from defective cores is necessarily much smaller than when made on the ordinary system, and the fue required for drying is also less. The standard size machine is for cores for pipes 9 ft. lay, the cores being about 10 ft. long, but machines can be made to produce cores 20 ft. in length

Improved Single and Double Automatic Motor Starting Rheostats.

THE Sturtevant Engineering Company, Ltd., of 47, Queen Victoria-street, have recently added a number of improvements to their single and double automatic motor starting rheostats.

To a very great extent the conditions which cover the design of a first-class starting rheostat have altered during the past two or three years, mainly because Corporations and Supply Companies have been raising the voltages of the supply and offering power to consumers at maximum voltages not previously in vogue. Those increased voltages have brought about more stringent rules for the protection of their network and their customers. The new conditions necessitate new types of motor starting and controlling apparatus, and it is to meet this demand that the "Igranic" starting switches have been produced.

The points necessary for the design of a reliable rheostat may be briefly stated as follows: There must be a sufficient number of contacts to ensure an easy acceleration of the motor. The starting rheostat must be provided with automatic releases to protect the motor in the event of failure of the supply, or of overloading. The resistances must be of ample carrying capacity, and must be so arranged that there is a minimum amount of sparking between the moving contact and fixed contacts. The method of assembling the resistance should be such that repairs in case of breakdown can be easily effected. The rheostat should be made of incombustible material throughout. No solder should be used in making the connections.

The resistance box should be so arranged that inspection of its interior can be made with little trouble. Ample ventilation should be allowed to prevent any portion of the starting switch overheating, and above all, the rheostat should be so designed as to give a high insulation resistance between any live part and earth.

The "Igranic" starting rheostat consists of a black enamelled slate front, having the contacts, between which the sections of resistance are connected mounted upon it, and a cast-iron ventilated resistance box.

The contacts are of two sorts: (1) The button contact, which is used for currents not exceeding 55 amperes; and (2) the renewable contact, which is segmental in shape, used for currents exceeding 55 amperes.

The rheostat fronts are made in two patterns, one fitted with automatic no-volt release, which allows the contact arm to return to the off-position, in case of failure of supply; and the other fitted with automatic no-voltage release and overload cutout, the overload coming into effect when the current exceeds a predetermined amount. The front is provided

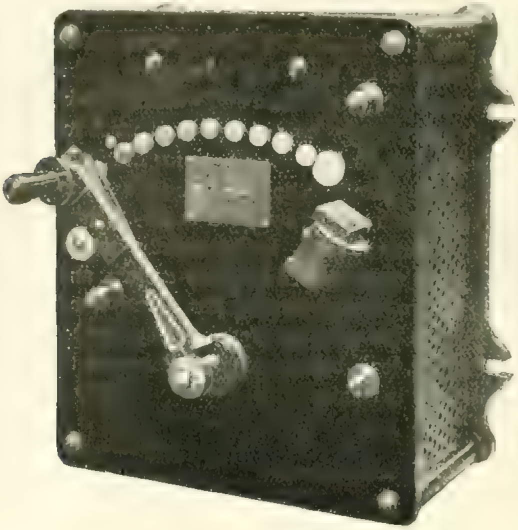


FIG. I.

with suitable terminals for taking the main cables, and a terminal is also provided for taking the connection from the shunt, in the case of shunt-wound machines, to the no-voltage release coil.

The principal feature in connection with the "Igranic" starting rheostats is the arrangement of the resistance box. The slate front described above is screwed to a cast-iron box and insulated therefrom by means of insulating washers and bushes. The resistance material is wound upon asbestos tubes, the asbestos tubes being supported by specially-formed porcelain insulators. The insulators are held in specially-arranged perforated supporting strips, thus ensuring a very high insulation between the resistance material and the metal box. The connections between the contacts on the slate front and the sections of resistance are made by means of specially-formed clips, the connections all being made in chambers at either end of the resistance box.

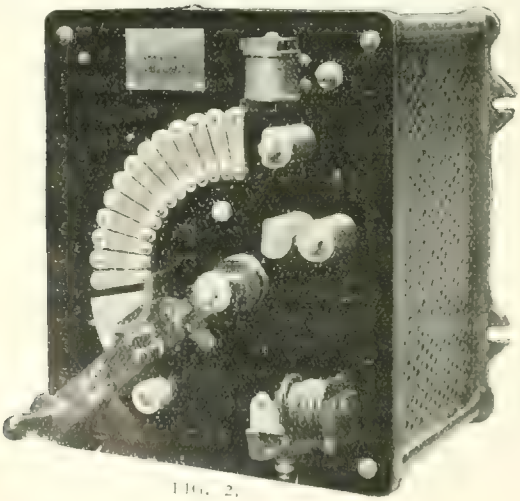


FIG. 2.

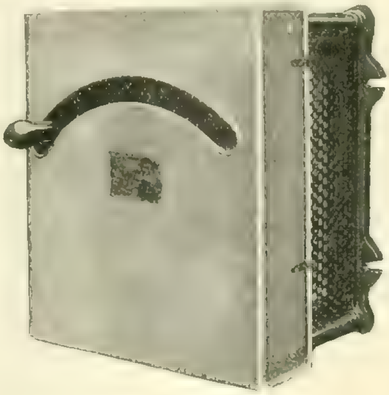


FIG. 3.

There are no internal connections in the resistance box, and every joint can be inspected at a moment's notice. The top, bottom, and sides of the cast-iron resistance box are covered by perforated sheet metal, held in position by spring clips at the corners. It is, therefore, possible to open up and inspect the resistance box without removing a single screw, and without requiring any special tools. All that has to be done is to remove the spring clips from the corners, take away the perforated sheet sides, and the whole of the interior is exposed to view.

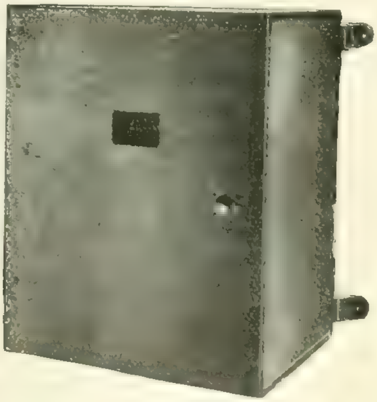


FIG. 4.

Figs. 1 and 2 show the open type; fig. 3 the semi-enclosed pattern provided with a metal cover to protect the operator against contact with any live parts, and fig. 4 the totally-enclosed pattern, which is suitable for positions where dust, etc., would interfere with the working of the rheostat.

The new rheostats can be adapted for series, shunt or compound-wound motors.

LAUNCHES AND TRIAL TRIPS.

THE *C[illegible]*, a cable steamer which has just been completed by Messrs. Swan, Hunter, and Wigham Richardson, Ltd., ran a very successful trial trip on Tuesday, January 31st. The steamer has been built to the order of the Telegraph Construction and Maintenance Company, Ltd., for whom the same builders recently constructed the *Colonia*, the largest cable steamer afloat. The *C[illegible]*, however, is a much smaller boat and will be used not only for laying new cables, but also very extensively for repairing old ones. The steamer is classed at Lloyd's 100 A1. She has an overhanging bow and stern, on which are fitted the cable sheaves, and in her holds are tanks for carrying cable. Her engines have also been built by Swan, Hunter and Wigham Richardson, Ltd., and consist of two sets of triple expansion engines, which, on the trial trip, propelled the vessel at a speed of 13 knots. The Telegraph Construction and Maintenance Company were represented by Mr. F. R. Lucas, and there were also present Captain Cato, Mr. C. Slater, and Mr. G. Scott, N.A.

The new coastguard steamer *Squirrel*, built and engined by Messrs. Workman, Clark and Co., Ltd., has left Belfast for Sheerness, under the command of Lieut. E. H. Dobbin. The *Squirrel* is a smart-looking steel screw steamer, of yacht-like appearance, with an armament of two three-pounder quick-firing guns, and is in every respect fully equipped in accordance with the Admiralty requirements. Comfortable accommodation for officers and crew has been fitted complete with every requirement, while ample space is provided for the various stores, etc., required in the coast-guard service. The machinery consists of triple expansion engines with all necessary auxiliaries, including steam-steering gear and windlass, steam being supplied by a steel multitubular boiler, working at a pressure of 155 lb. per square inch. During the past week the vessel has undergone a complete series of trials, comprising power, speed, steering, gun firing, and anchor trials; also stability tests. The power trials included an eight-hour full power trial. All these tests were carried out most successfully, and to the complete satisfaction of the Admiralty officers. (See page 282.)

There was recently launched from the yard of Messrs. Palmer's Shipbuilding and Iron Company, Ltd., Jarrow, a steamship, *The Chama*, for Messrs. Elder, Dempster and Co., of Liverpool. The *Chama* is 350 ft. long, 48 ft. broad, and 23 ft. 4 in. deep. She has been designed to lift about 4,[illegible] tons dead weight on her summer load draught.

The steel screw steamer *Bennie*, built to the order of Messrs. Elder, Dempster and Co., for their West African trade from Liverpool, has been launched from the East Shipbuilding Yard of Messrs. Swan, Hunter and Wigham Richardson, Ltd., Wallsend-on-Tyne. The vessel is of the following leading dimensions: Length over all 302 ft.; beam extreme, 48 ft. [illegible] in., and depth moulded, 32 ft. to shelter deck. The vessel is expected to carry a dead-weight cargo of about 4,[illegible] tons on a draught of 21 ft. The machinery has been constructed by the Wallsend Slipway and Engineering Company.

The large steel screw steamer *H[illegible]* proceeded on her official trial trip, after adjusting compasses in Hartlepool Bay. The vessel has been built by Messrs. Furness, Withy and Co., Ltd., Hartlepool, to the order of Messrs. J. and C. Harrison, Ltd., and is the second of three sister ships for the same owners. She is over 335 ft. in length, built on the deep-frame principle, with a measurement capacity of 264,126 cubic feet. The main engines have been supplied and fitted by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool.

Messrs. Archd. McMillan and Son, Ltd., shipbuilders, Dumbarton, launched recently the steel screw steamer *Saint Jerome*, the second of two which they have built for the order of Messrs. Rankin, Gilmour and Co., of Liverpool. The moulded dimensions are: Length, 345 ft.; breadth, 47 ft. 6 in.; depth, 24 ft. 9 in.; and the vessel is designed to carry a dead weight of 5,500 tons on a light draft. Machinery is being supplied by Messrs. Dunsmuir and Jackson, Ltd., Glasgow, for a sea speed of 10 knots.

On Monday afternoon the 6th inst., Messrs. Ropner and Son, Stockton-on-Tees, launched from their yard a steel screw steamer, *Blacktor*, of the following dimensions: Length, 330 ft. 1 in.; breadth, 46 ft.; depth, 24 ft. 4 in. The vessel will be classed 100 A1 at Lloyd's, and is built on the three-deck rule, having one deck laid and clear holds, full poop, long bridge, and T. C. forecastle. The vessel has a double bottom for water ballast on the cellular principle, and also in the after peak. The appliances for loading and discharging the cargo expeditiously are very complete and include six steam winches, steam being supplied by a horizontal multitubular donkey boiler.

MECHANICS OF FLOUR MILLING.

A paper on this subject was read before the Civil and Mechanical Engineers' Society on February 2nd, by Mr. A. R. Tatterrsall. The following is an abstract:—

Much of the controversy amongst milling engineers has waged around the design of the roller mill itself. The essential features of a successful roller mill have eventually been proved to be—first, a roll, having elastic levers, which would keep the adjustable roller at its work and at the same time allow any hard or metallic substance which might get between the rolls, to pass through without breaking the lever; secondly, bearings having oil-circulating arrangements; thirdly, chevron gears to maintain an exact differential speed between the two rollers working together; fourthly, a reliable adjustment to ensure an even pressure along the whole surface of the roll; fifthly, an even distributed feed across the roll, which must be spread out in as thin a stream as is possible; and, lastly, the whole set up in a substantial framework, so as to obviate any tendency to vibration and offering easy access to all parts requiring adjustment, the whole so placed that the machine can be properly ventilated with the dual object of keeping the stock cool and preventing the escape of dust. The actual grinding surfaces are made of chilled iron cast in an iron mould. As these rolls are used in flour manufacture for two purposes, "breaks" and "reductions," to make a difference in the metal used for each purpose is the best practice, and for this reason, that the "break" rolls, after having been ground true on the emery wheel are fluted or grooved by a special tool with a slight lead or spiral twist of about 1 in. per 1 ft. in the length of the roller to break open the wheat as it passes, whereas the "reductions" or grindings of the semolina are made on entirely smooth surfaces so that the metal composing the casting may be denser and harder. The cast roller is hollow in the middle, but each end is cored so as to require boring to receive the spindle, which is turned slightly thicker than the hole left, so that the spindle is forced into its place by means of hydraulic power, and is not keyed on. Experience has shown this to be the only satisfactory method of securing the spindle. Another feature to be pointed out is that the two rollers running in contact are revolving at differential speeds, 250 to 100 for "break" or grooved rolls, and 250 to 200 in the case of smooth rolls. This differential speed is maintained by means of chevron gears, working in oil-tight cases, so that, when in operation, they are comparatively noiseless. The rolls are now generally placed on the diagonal method, that being considered better than to give them horizontal setting (fig. 2).

Another debatable matter in connection with these rollers is as to which roller of the two should be the fast and which the slow roller. It is obviously mechanically correct to make the fast roll the one running in fixed bearings, and the adjustable roll the slow running one, but in the case of rolls shown by the author this slower roll is placed below the other, so that the pressure is exerted upwards against the top one to do the grinding

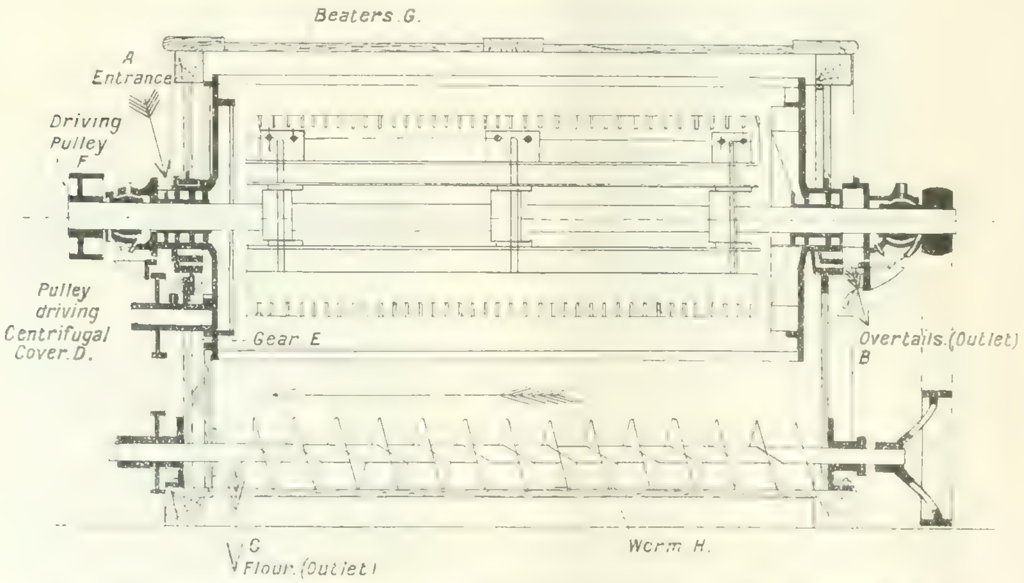


FIG. 1.—CENTRIFUGAL FLOUR-DRESSING MACHINE WITH WORM FEED AND OUTLET.

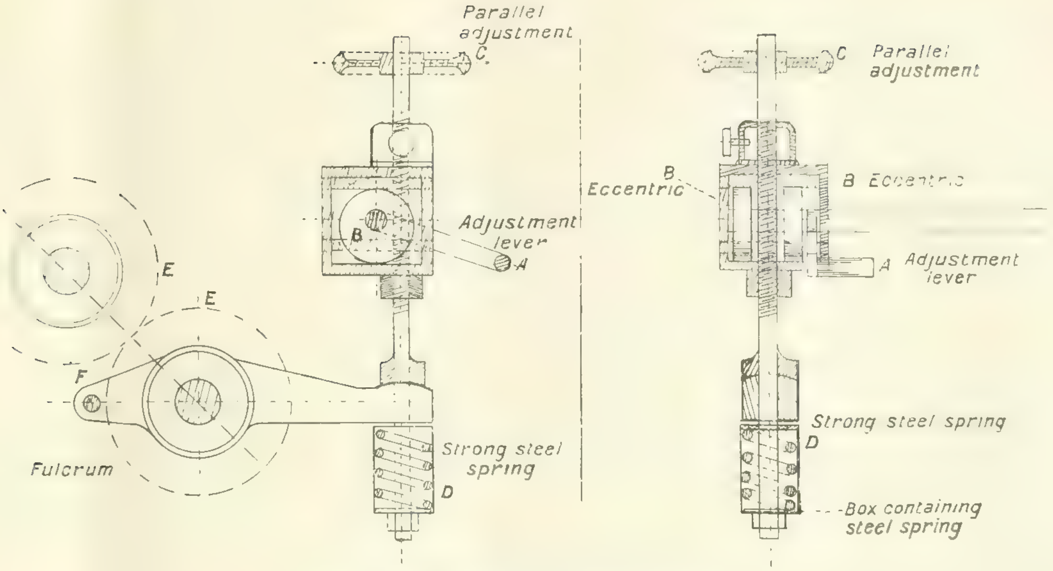


FIG. 2.—ADJUSTMENT OF DIAGONAL ROLLS

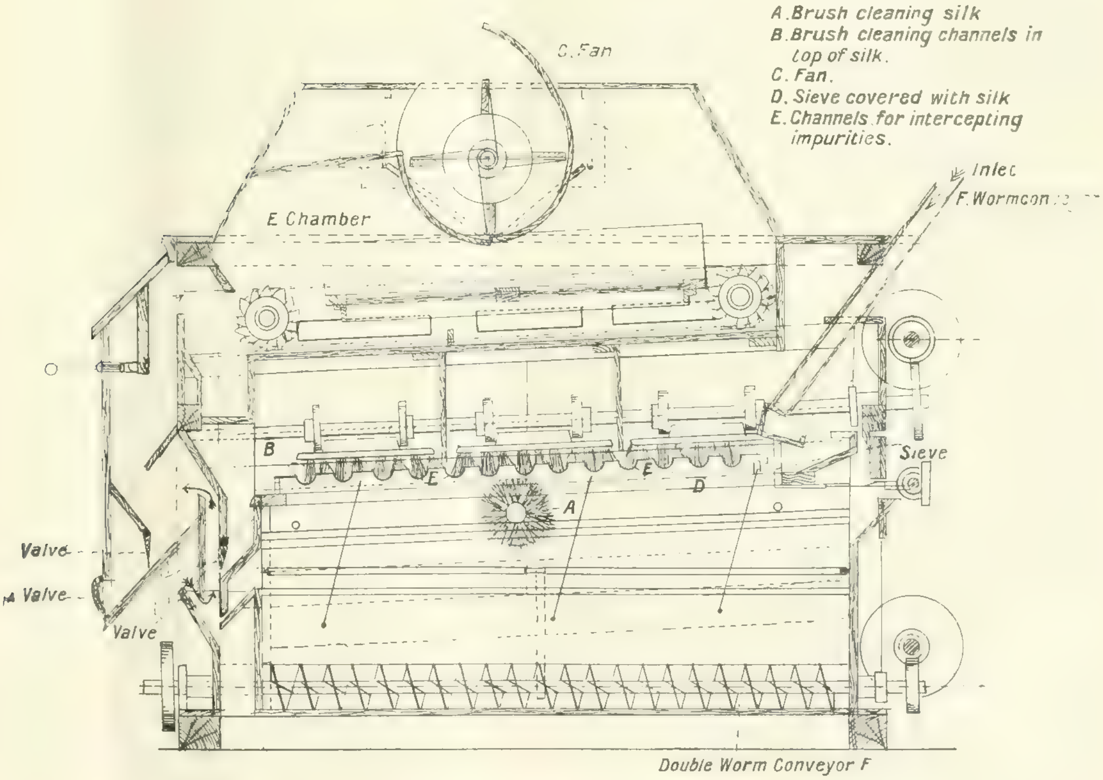

A. Brush cleaning silk
B. Brush cleaning channels in top of silk.
C. Fan.
D. Sieve covered with silk
E. Channels for intercepting impurities.
C. Fan
E Chamber
Inlet
F. Wormcon
Sieve
B
E
E
D
A
Valve
Valve
Valve
Double Worm Conveyor F

FIG. 3.—DUSTLESS PURIFIER

The second machine of importance is the purifier (fig. 3) which has to deal with all the semolina and middlings made in the process of breaking down the wheat on the fluted rolls. After the little flour has been dusted away this semolina is graded into several sizes, and passes on to the several purifiers, clothed with suitable numbers of woven silk according to the size of the stock it has to deal with.

This purifier consists of a vibrating sifter D, having a slight inclination from head to tail, and enclosed in an air-tight frame. A fan C is superposed which sucks or draws air up through the silk covered sieve, taking with it all particles of less specific gravity than the pure stock; the latter drops down through the silk into a collecting worm F. The space down the sieve is divided across by wooden partitions, to each of which an air current is supplied of varying strength, light at the head end where the silk cover is finest, and heavier at the tail end where the silk cover is coarser.

The air as it passes away from the silk to the fans, laden with the light impurities, passes through a series of channels E E, placed quite close to the silk, and after passing through these channels expands, and the heavier particles drop into these channels while the lighter ones pass upwards into a large expansion chamber E C, and are caught while the pure air blows out at the mouth of the fan into the room.

SOCIETY OF ENGINEERS.

Mr. Nicholas J. West, the new President of the Society of Engineers, delivered his presidential address on Monday evening last. He chose for his subject a branch of the mechanical side of engineering more particularly with reference to the historical use and improvement of pumping and marine engines

At the same meeting the retiring President, Mr. D. B. Butler, presented the premiums awarded for papers read during the year. The President's gold medal was awarded to Mr. William Edward Storey for his paper on Condensing Machinery; the Bessemer Premium of Books to Mr. R. G. Allanson Winn for his paper on Deep Sea Erosion and Foreshore Protection; a Society's Premium of Books to Mr. A. S. E. Ackermann for his paper on British and American Coal-cutting Machinery; and a Society's Premium of Books to Mr. Frank Latham for his paper on Some Recent Works of Water Supply at Penzance.

OVERHEAD MAINS.

At the meeting of the Institution of Electrical Engineers, held at Great George Street, S.W., yesterday, a paper by Mr. G. L. Addenbrooke was on the agenda, "The Value of Overhead Mains for Electric Distribution in the United Kingdom," of which the following is an abstract:—

On the Continent and in America, outside considerable towns, electric transmission has almost universally been carried out by means of overhead mains. Unfortunately, until recently in this country, officialism and to some extent public sentiment have prevented the employment of this method on any scale.

Wiser counsels now prevail, and it is now possible to consider systems of transmission of this character in the United Kingdom, and it becomes of practical importance to see how they compare with underground transmission, and what difference their employment may make in the policy and procedure of power companies.

The tables on page 317 show the cost of overhead conductors and underground mains employed under similar conditions. The figures must be regarded as approximate, as so much depends in any given case on the amount of work to be done, the locality and other conditions, but still they are near enough for the present purpose. The costs in both cases are for high-class work, and this applies particularly to overhead work.

An inspection of these tables will show that at 6,000 volts between conductors on a three-phase system the cost of the overhead conductors is about half that for underground cables. If the voltage is increased, the cost of the overhead line only rises slightly, while the cost of the cables increases more rapidly, so that at 10,000 volts the cost of underground is nearly three times the cost of overhead transmission. In the cost for the overhead transmission a fair sum is included for extra poles and networks when crossing roads or places to which the public have access.

In these tables the costs of overhead conductors have been calculated on the basis of a single set of conductors of the sizes mentioned on a pole, but when more power is wanted a second set of conductors can usually be added at the cost for copper, insulators, arms and erection only, whereas to lay a second cable will cost practically as large a sum as the first. Herein lies one of the great advantages of overhead distribution. Thus, by employing overhead conductors a power company is sinking a much smaller amount of capital in extending its mains widely during its early stages.

OVERHEAD MAINS.—THREE-PHASE CABLES.

On the Basis of One Per Cent. Loss per Mile.

Particulars of the Conductors			Carrying Capacity in Kilowatts at the following Voltages				Capital Cost of Line complete per Mile, allowing 45 Poles per Mile at the following Voltages				Capital Cost of Line complete per Kilowatt conveyed per Mile at the following Voltages			
Size of Cables	Section of Cables in Square Inches	Weight per Mile in lbs	6,000	8 000	10,000	12,000	6,000	8 000	10 000	12 000	6 000	8 000	10 000	12 000
3—7/18	3 01292	3 × 266	81	152	225	323	£211	£230	£245	£260	52/-	30/-	22/-	16/-
3—7/16	3 02209	3 × 468	143	254	400	545	£259	£275	£290	£305	36 3	21 8	14 6	11 3
3—7/14	3 03588	3 × 730	222	394	615	887	£301	£316	£332	£347	27/-	16/-	10 9	7 10
3—19/16	3 06247	3 × 1270	382	680	1,060	1 526	£402	£418	£433	£448	21/-	12 4	8 2	5 10

UNDERGROUND MAINS.—THREE-PHASE CABLES.

On the Basis of One per Cent. Loss per Mile.

Particulars of the Conductors			Carrying Capacity in Kilowatts at the following Voltages				Cost of Main complete laid and jointed at the following Voltages				Cost of Line complete per Kilowatt conveyed per Mile at the following Voltages			
Size of Cables	Section of Cables in Square Inches.	Weight per Mile in lbs	6,000	8,000.	10 000.	12,000.	6,000.	8 000	10 000.	12 000	6 000.	8 000	10 000	12 000
3—7/18	3 01292	3 × 266	81	152	225	323	£490	£540	£678	£800	120/-	71/-	60	47/6
3—7/16	3 02209	3 × 468	143	254	400	545	£520	£635	£725	£870	73/-	50/-	37/-	32/-
3—7/14	3 03588	3 × 730	222	394	615	887	£545	£660	£772	£950	49/-	34/-	[illegible]	21/-
3—19/16	3 06247	3 × 1270	382	680	1,060	1 526	£760	£855	£957	£1 050	40/-	25/-	18/-	13/9

Besides the lower cost per mile of the distributing system with overhead mains, and which in many cases would make the difference whether a supply can be given profitably or not, it is important to observe also that if it will pay to carry the current a certain distance by underground mains, it will pay to carry the current nearly twice as far with overhead conductors; which means that a power station can economically supply current over about three times the area which would be possible with underground transmission at 6,000 volts, and if the pressure is increased the relative areas show a still greater difference.

It is also important to bear in mind that overhead conductors are, comparatively speaking, free from the complicated phenomena known as resonance effects, which give a good deal of trouble on underground circuits and have been the cause of much anxiety.

There is no reason why, with overhead distribution and a cheap system of wiring, such as is in use everywhere except in this country, all these smaller centres of population and the outskirts of the larger towns should not enjoy the benefits of electric light and power supply, which they are hardly likely to do for another twenty years without this system of distribution.

It is, further, worth pointing out that most of the local distribution abroad is at 110 volts. With 240 volts, such as we use largely here, the problems involved are much simpler.

It ought to be the function of power companies to feed these towns and villages by lines of overhead mains radiating twelve to fifteen miles in all directions round each power station, and the undertakings being in groups, economic and effective administration would be secured, and the disadvantages and lack of efficiency of separate small undertakings would be avoided.

That there is a large field open for future work in this direction, no one who has studied the question will deny, and it is very much allied to the question of inter-urban electric railways, in which so much progress has already been made in the United States.

In conclusion, the author refers to another class of overhead electric distribution which is fast attaining an important place, namely, distribution at very high pressures such as 50,000 volts. The continued success and extension of such installations warrants them being considered not only as local enterprises specially arranged to meet some unusual set of conditions, but as being of general application. When electric distribution is effected at these voltages, not only do we get into a new order of phenomena electrically, but economically also. The capital cost of the line comes down to from 1s. 6d. to 2s. per kilowatt conveyed per mile, with a loss of, say, one-fifth of 1 per cent. per mile. The overhead electric transmission of power and light will be one of the most potent factors in developing new industrial and mining regions in the next twenty or thirty years.

HYDRAULIC PRESSING, STAMPING AND FORGING MACHINERY.

(*Continued from page 264.*)

HYDRAULIC FORGING PRESSES.

Valves are generally the most vital portion of a press, a badly designed valve being a source of endless trouble and expense. In a slow working press for low pressures the valve is usually made of the screw down type, or of the leather packed piston type, or slide valve type. Beyond 1 ton per square inch, valves are made of the balanced mitre type with forged-steel bodies and heavy phosphor bronze fittings. In a large press of quick action and heavy pressure, where the valves and pipes are of large area, it is necessary for the valves to be hydraulically or fluid worked.

Circumstances determine whether the motive power shall be hand, electric or steam.

In presses, of large power, say of 500 tons and upwards, it is essential that every part should be extra strong and rigid, and all parts with a low stress. The load may not always be central on the work, for which contingency the columns are usually proportioned on each side to take three-quarters the load with very deep guides on the crosshead for side strains. In presses of large calibre the entablature and base are often built up of cast steel girders joggled and bolted together, or with steel hoop shrunk on over snugs to take any side stresses. The presses are operated in different manners, one method being to have a steam accumulator for operating the lifting cylinders, and a set of three-throw hydraulic pumping engines for pumping direct at a pressure of three tons per square inch into the press cylinder, the main ram falling by gravity and filled with water from an overhead tank. With the pumping engine system, the steam consumption is more economical than with direct steam drivers. In a large forge works this is of not such great importance, as the waste gases from the heating furnaces are utilised for generating steam. Probably for which reason the steam hydraulic press is largely used, this type also having the advantage in first cost. A description of its working may be interesting.

The squeeze is applied by means of a steam-driven intensifier. The hydraulic cylinder of the intensifier is connected by a pipe to the cylinder of the press and the pipe and the two cylinders are kept filled with water from an overload tank through a valve, which opens downwards to admit water from without, and closes against any pressure from within the cylinders.

METHOD OF WORKING.

The area of the steam piston and that of the ram of the intensifier are so proportioned to each other that a pressure of steam produces a pressure 3 tons per square inch on the water above the forcing ram. To squeeze the forging, the workman depresses a hand lever, which moves a valve admitting steam below the piston of the intensifier, causing the forcing ram to drive the water into the cylinder of the press; the ram and crosshead is thus moved downwards, By raising the lever steam escapes from below the piston of the intensifier, when the piston and ram fall by gravity. The lifting of the moving head of the press is actuated by two cylinders on top of press; in this press steam instead of water is used to do the lifting, the admission of steam to the lifting cylinders being controlled at will by a small three way cock, which enables the press to be worked in two distinct ways.

In the usual method of working, the pressure of steam is maintained continuously below the pistons of the lifting cylinders, thus holding the head up until steam is admitted below the piston of the intensifier, which overcomes the pressure of the steam in the lifting cylinders and drives it back into the boiler. On again releasing the steam from below the piston of the intensifier the lifting pistons regain their power and force the water back into the top of the intensifier, but as the quantity contained in the pressing cylinder and intensifier with their connecting pipe remains constant, the moving head of the press rises and falls through a distance due to the influence of the pressing and lifting cylinders. These prevail alternately one over the other, the rise and fall between the two fixed points being in accord with the movement of the workman's hand, thus squeezing the forging and permitting it to be moved along after each stroke ready for a fresh squeeze to be taken on a new part. If the normal stroke of the crosshead is insufficient it can be made to travel through a second and lower interval by merely turning the three way cock. This shuts off the constant supply of steam below the pistons of the lifting cylinders, with the result that the head remains stationary and water flows in from the overhead tank, and fills the vacant space left by the forcing ram of the intensifier. Then, as soon as steam is admitted below the piston of the intensifier, the press head descends through a second interval. This action may be repeated until the whole available stroke of the presshead is used up, or until the material under treatment offers such resistance that it must be moved into a new position for another part to be squeezed.

FUEL ECONOMY IN STEAM POWER PLANT.

There was an interesting discussion on Messrs. Booth and Kershaw's paper on this subject at the last meeting of the Institution of Electrical Engineers.

Mr. John C. B. Kershaw opened the proceedings with a few experiments in illustrations of the paper. His first experiments were designed to show the different character of the gases given off when using anthracite, South Wales steam, and ordinary Lancashire coal. The anthracite contained 3·7 per cent. of volatile matter, the South Wales steam coal 12 per cent., and the bituminous specimen 32 per cent. He next illustrated by the aid of a candle and a piece of copper wire the manner in which a cold surface brought into contact with a flame robs it of its heat, and then showed through the agency of a wire gauge and a Bunsen flame the effect of a cold conducting surface. It remained to be considered, he pointed out, whether scale was a worse conductor than boiler-plate iron, and another experiment was designed to show the relative heat conductivity of boiler-plate scale and oil scale. He wished to emphasise the importance of testing the flue gases.

Col. Crompton said that the matters discussed in the paper were of the first importance to electrical engineers, particularly those connected with power and lighting plant. With regard to the question of temperatures of flames and the cooling surfaces of boiler plates, he agreed with the authors. There was no doubt that a great deal of the discredit brought upon water-tube boilers in their early days was due to mistakes in the brickwork setting. The ideas of some people with regard to smoke consumption were limited to passing excess of air through the furnace and thus producing a cooling effect. The problem was to prevent smoke without loss, and in this respect the author's remedy was the correct one. It was a question of suitable furnace construction. Then there was what he might fairly term the great puzzle of thermal storage, which he thought was going to be one of the great advantages which electrical engineers could introduce into stations where they had to deal with a peak load. Thermal storage produced economies which were quite inexplicable with the light of present knowledge. It was not a question of getting 25 or 30 per cent. extra, but 200 per cent. extra gain in boiler power at the peak. The problem was being investigated and he hoped that in a year or two the electrical industry would be in possession of some useful facts in this connection. Thermal storage had reduced coal consumption in a station which was previously a model for economical working in other respects, by the difference between 4 and 2·0.

He differed from Mr. Booth in his hankering after Lancashire boilers. With the water-tube boilers the furnaces could be designed in a manner impossible with the Lancashire. The furnace problem was a fuel problem. He did not think that the results to be obtained with the inclosed grate were at all comparable with those to be got from a flat grate working on the chain principle, or on the principle which propelled fuel from the front to the back and only passed it through when combustion had been completed.

To the question of superheated steam he had paid a good deal of attention, and the views he held were those of people with whom he was not ashamed to be in company. With superheated steam, advantages were obtained the whole way up the scale, so that 1,000° F. was better than 500 deg. The use of very highly heated steam had produced results which could not be accounted for by the ordinary third law, and the only explanation was that former knowledge was incomplete. Quite apart from the thermo-dynamic advantage, it had been pointed out by Messrs. Callender and Nicholson that superheated steam had enormous advantages in preventing leakage over sliding surfaces. With regard to the charge made against superheated steam of scoring and cutting the cylinder it only needed that it should be lubricated to a certain extent. With steam at 300 deg. to 400 deg. above the saturation point consumption could be reduced from 30 to 40 per cent. On this subject a new practice could be built up with steam engineering. In this way the steam engine could be made to keep pace with the internal-combustion engine. The time would come when steam would be taken at 1,000 deg. and discharged at 200 deg.

Mr. Boot said that he found no difficulty in separating the grease with a separator, the only objection being the loss of 5 per cent. of water in addition to the ordinary losses. He had tried the heating of feed water to the same temperature as the water in the boilers, and the deposits were thrown down in trays arranged for the purpose. It was impossible to carry out all the tests suggested in the paper by reason of the number of men required. Station engineers looked at the lbs. of coal per unit, and if they found the consumption going up they then looked into the matter. They were compelled to regard the coal per unit test as a sufficient one. He was surprised to hear Col. Crompton speak against Lancashire boilers which certainly had their uses in an electrical plant where there were variations of loads and where steam had to be stored ready for use at a moment's notice.

With regard to retractory furnaces it had often been a surprise to him why some makers of water-tube boilers continued to sell boilers designed on barbarous principles as far as fuel combustion was concerned. The question of the kind of fuel to be used was to a large extent a question of location and carriage, and where rates were high it was cheaper to use the best coal. He, personally, had never got above 18 per cent. saving by the use of superheated steam.

Mr. Halpin did not believe in paying fancy prices for coal, as the extra work was not worth the extra price. Inferior coal could be used without smoke and to the best possible results.

Mr. Dale said that at Messrs. Crossfield's Works, Warrington, owing to the varying hardness of the water they analysed it every day. They had obtained great advantage in the matter of superheating by utilising the top of the Lancashire boiler, usually covered with non-conducting material, as a heating surface and sending the gases through tubes into the superheating chamber. In that way they gained about 70 deg. to 80 deg. of superheat. The arrangement had been in use for several years and worked satisfactorily.

The discussion was adjourned.

An 8-ft. steel chimney, 230 ft. in height has just been completed and will be erected in Mexico. This will be the highest steel chimney in America.

The orders given in January for new vessels to be built on the Clyde are stated to equal 169,000 gross tons, and to be a record in tonnage. The north-east coast shipbuilders during the same period received proportionately large orders. Belfast claims to have secured 210,000 tons of new work.

Mr. James C. Inglis, general manager of the Great Western Railway, has been nominated by the Council of the Institution of Civil Engineers as one of their representatives on the Engineering Standards Committee, in the place of the late Mr. John Allen McDonald, engineer-in-chief of the Midland Railway.

It is a significant fact that to the 1905 edition of Garcke's Manual of Electrical Undertakings and Directory two hundred more pages have been added, bringing the total up to about 1,700 pages, which is over four times the size of the first volume, published in 1896. The number of undertakings about which particulars were given in the first volume was two hundred now that figure has grown to close on 2,400, while the amount of capital issued in connection with these undertakings, which include, of course, both municipal and joint-stock enterprises, has risen from a little over £61,000,000 to close on £267,000,000.

AN ELECTRIC WINDER FOR THE RAND.

The first large electric hoist adopted for deep-level developments on the Rand has been ordered for the Village Main Reef Gold Mine. The winder will be placed at a vertical depth of 1,100 ft. and will haul on a 1,700 ft. incline. The generating plant will be of 900, and the hoist of 500 h.p. Messrs. W. H. Allen, Son and Co., represented locally by the Technical and Commercial Corporation, Ltd., will be the manufacturers of the steaming plant, and Fraser and Chalmers, Ltd., of the mechanical parts of the hoist, whilst the electric installation will be provided by the A. E. G. Electrical Company of South Africa. The three-phase system as adopted by that Company with a liquid starting resistance will be used, and it is expected that the plant will be at work in about seven months.

OBITUARY.

Mr. Frederick Gordon, whose death is reported from Sunderland, had extensive business interests on the East Coast. He was managing director of Johnasson Gordon and Co., Ltd., of Newcastle, the East Coast Engineering and Shipbuilding Company, Tyne Dock, and of the Gordon Steam Shipping Company, Ltd., London and Newcastle. He was also a member of the River Wear Commission, and his experience admirably fitted him for the chairmanship of the Traffic Committee of that body.

Mr. James E. Ransome, to whose death reference is made elsewhere, was a man of many parts. To the engineering public he was chiefly known as the head of the famous Ipswich firm, founded by his grandfather in 1789. Mr. James Ransome has been the head of this undertaking for many years, and he worthily sustained the high traditions of a great business. It was natural, of course, that his name should have been associated with the Royal Agricultural Society, and he was also on the Council of the Bath and West of England Society, and the Agricultural Engineers' Association. Nor did his activities end here, for he played an important part in Ipswich local affairs, and was intimately associated with the extension educational facilities in that town. His death at the comparatively early age of sixty six is a matter for genuine regret.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

	Last Day.
Ghent.—Supply of fifteen electric cranes for use in connection with the docks. Hotel de Ville, Ghent	Feb. 13
Bury.—Supply and erection of one 500 k.w. direct-current high-speed generating set. Mr. S. J. Watson, Electricity Works, Bury	Feb. 14
Lagos.—The Crown Agents for the Colonies invite tenders for the supply of steel rails, fish-plates, and steel sleepers for thirty miles of single track. Crown Agents Office, Whitehall Gardens, S.W.	Feb. 14
Manchester.—Supply and erection of a main switchboard, auxiliary distribution board, etc, for car repairing works. Mr. J. M. McElroy, General Manager, Tramways Department, 55, Piccadilly, Manchester	Feb. 14
Merthyr Tydvil. — Supply of between 5,700 and 6,000 tons of cast-iron pipes for high-level aqueduct, valves, etc. Mr. George F. Deacon, 16, Great George Street, Westminster, S.W., or Clerk, Town Hall, Merthyr Tydvil	Feb 15
Bournemouth.—Three contracts in connection with tramways. (a) Steel grooved girder rails; (b) permanent-way construction and rail bonding; (c) wood blocks and granite at edging. Mr. F. W. Lacey, Borough Engineer, Bournemouth ...	Feb. 15
Newcastle-under-Lyme—Manufacture delivery and erection of three sets of gas engines and centrifugal pumps for sewage disposal works. Messrs. Wilcox and Raikes, 63, Temple Street, Birmingham...	Feb. 22
Fulham. — Supply of condensing plant, boilers, economisers and stokers. Mr. Arthur J. Fuller, Borough Electrical and Consulting Engineer, Town Hall, Fulham	Feb. 22
Chelmsford.—Pumping machinery including horizontal gas-engine and a vertical treble ram-pump to raise 10,000 gallons of water per hour. Mr. Jos. Dewhurst, Engineer, Avenue Chambers, Chelmsford.	Feb. 24
Copenhagen.—Supply and erection of a gasometer of a capacity of 200,000 cubic feet per hour for the Lighting Department of the Corporation. Valby Gasworks, Valby, Copenhagen	Feb. 27
Barcelona.—The "Gaceta de Madrid" of January 18th contains a notice calling for tenders for the supply and installation in the sheds of the Barceloneta wharf of two transhipment cars for platform cranes. Conditions of contract and plans may be inspected at the offices of the Secretary of the Port Administration, Casa Lonja, Barcelona	March 1
Johannesburg.—Supply of 100 electric cars, two electric water-cars, five-ton crane, car traverser, and workshop tools for Municipal Council	March 6
Stoke Newington. Supply, delivery and erection of sub-station plant and mains. Four-section contract. Mr. W. F. Loveday, Borough Surveyor, Town Hall, Milton Road, Stoke Newington, S.E.	March 8
Belgium.—The "Bulletin Commercial" announces that the Belgian State Railways invite tenders for the installation of two sets of ventilating and heating apparatus in the central workshops at Mechlin. Particulars of M. Slaghmuylder, Engineer-in-chief, Station du Nord, Brussels ..	March 6 March 13
South Shields.—Supply, delivery and erection of the following plant in connection with the electricity supply department:—One multitubular marine type boiler, two medium-speed open-type vertical engines for two 550 k w. direct current traction generators, two 500 k.w. direct current generators and traction switchboard. Mr. J. H. Cawthra, Borough Electrical Engineer	March 13
Madagascar.—Plant and machinery are required for the establishment of a pumping station at Majunga, Madagascar. Particulars may be obtained from the Minister of the Colonies, 4, Rue Jean Nicot, Paris	—
Chile.—News has been received at the Commercial Intelligence Branch of the Board of Trade from the British Vice-Consul, at Santiago (Mr. A. C. Kerr), notifying that tenders for the Valparaiso harbour works will be opened in April, 1906. Specifications will be sent to the various Chilian Legations in Europe and the United States	Apr. 1906

COMING CONTRACTS.

Hammersmith.—The London County Council has sanctioned the borrowing by the Borough Council of £18,482 for electric supply purposes.

Hull.—A sum of £36,000 will be spent during the ensuing financial year on electrical engineering works.

Macclesfield.—A proposal is being put forward to borrow a sum of £20,000 for electric supply purposes.

Wakefield.—The Corporation has under consideration a scheme which involves the spending of £18,000 on electric supply plant.

Sunderland.—Application is being made for a loan of £15,000 for additional electric supply plant.

Western Valleys (Mon.)—It is intended shortly to advertise for tenders for sewage works at an estimated cost of about £257,000.

London.—The City and South London Railway is about to invite tenders for the construction of express cars.

CONTRACTS CLOSED.

Cheltenham.—The Corporation has accepted the tender of the Lancashire Dynamo and Motor Company, Trafford Park, for automatic reversible booster, Turnbull and McLeod pattern, with switchboard.

London.—The Thames Electrical Engineering Works have placed orders with Reavell and Co., Ltd., for engines for twenty lighting sets for London County Council steamers.

Canterbury.—Davey, Paxman and Co. have secured an order for a generating set from the Swindon Corporation, and a contract for boiler and superheater from the Canterbury Town Council.

Dover.—The Dover Town Council has accepted the tender of the British Electric Equipment Company, Ltd., for the construction of the permanent way, overhead equipment, and laying the feeder cables in connection with the Dover and River Light Railways.

London.—The London General Omnibus Company have ordered six motor-buses from the Wolseley Company, to be ready by the end of March. The Great Western Railway Company and the Birmingham Motor Express Company have also ordered motor-buses from the Wolseley firm.

South Africa.—Ernest Newell and Co. Ltd., have secured a large order for tube mills for grinding concentrates down to slime for a large gold mining company in South Africa.

G. I. P. Railway.—The Great Indian Peninsula Railway have given a contract to Kerr, Stuart and Co. Ltd., for motor coaches as designed by that firm.

London.—The Hart Accumulator Company have given an order to Measures Bros. Ltd., for cast-iron columns and rolled steel joists.

Birkenhead.—The Tranmere Bay Development Company, Ltd., Birkenhead, has ordered from the Power-Gas Corporation, Ltd., a power-gas plant of 6,000-h.p. capacity. The larger portion of the gas generated is intended for firing furnaces; the remainder will drive two 400 indicated h.p., and three 250 indicated h.p., Premier gas engines, each direct-coupled to a Bruce Peebles dynamo.

Shipley.—Graham, Morton and Co. Ltd., Leeds, have just obtained an order from Messrs. Jonathan Barker and Co., Esholt, Shipley, for the installation of an overhead tram-rail. By the introduction of this plant it has been estimated that a saving will be effected sufficient to pay for its installation within a year.

Sunderland.—The River Wear Commissioners have placed an important contract for structural work in connection with the erection of additional coal staithes at the South Dock, Sunderland, with John Abbot and Co., of Gateshead.

Glasgow.—Brownlie and Murray, Ltd., have just received contracts for shipment abroad, among these being a furnace for the City of Calcutta, steel structural work for 480 ft. span suspension bridge, buildings for two large engineering shops.

Bishop Auckland.—Graham Morton and Company, Ltd., have secured a contract to make additions to the extensive coal screening plant for the Dean and Chapter New Colliery, at Bishop Auckland, County Durham, belonging to Messrs. Bolckow, Vaughan and Company, which will enable it to handle 5,000 tons per day.

London.—Among orders recently executed and received by the Paterson Engineering Company, Ltd., for "Paterson Feed Water Purifiers" are the following: Messrs. Babcock and Wilcox, Ltd., for H.M. Dockyards, Pembroke; Gosport and Fareham Tramways; Messrs. Belliss and Morcom, Ltd., for their Ledsam Street Works; Messrs. Danks and Company for H.M. Dockyards, Chatham; Messrs. The Electric Construction Company (2) for H.M. Dockyards, Gibraltar; Messrs. The Mirrlees Watson Company for Partick Electricity Works; Messrs. Crompton and Company for Ultadunga Station, Calcutta; Messrs. The Earl of Rosslyn's Collieries Company, Ltd.

APPOINTMENTS VACANT.

Last Day

Birmingham.—Chemist to take charge of a new 20-ton per diem coal-testing plant, fitted with regenerative retort settings. Chairman of Works, Sub-Committee of Gas Department, Council House, Birmingham ... ... Feb. 20

City Corporation.—Mr. D. J. Ross, engineer and surveyor to the City Corporation, is retiring on account of ill-health. At a joint meeting of the Officers and Clerks, the Finance and the Improvements committees, it was decided to advertise for a successor. The salary was fixed at £1,500, rising to £2,000. Candidates must not be over fifty years of age .. ... —

London County Council.—Engineering assistant, at a salary of £500 per annum. Must be a member or associate member of the Institution of Civil Engineers, and have had experience. Particulars of Clerk to the Council, Spring Gardens, S.W. ... ... Feb. 20

Newcastle.—Electrical Engineers to take charge of shift at Carville Power Station. Mr. J. S. Watson, Newcastle-upon-Tyne Electric Supply Company ... ... —

APPOINTMENTS FILLED.

Hanley.—The Hanley Corporation has appointed Mr. C. H. Yeaman, chief assistant in the Islington Borough Council electricity works, as borough electrical engineer of Hanley.

Wakefield.—The Wakefield Electricity Committee has recommended that Mr. H. A. Neville, chief assistant engineer at the electric supply works, shall be chief electrical engineer. The commencing salary is £300 per annum.

Manchester.—Mr. C. H. K. Chamen, who has been employed at the Glasgow Corporation electricity works as mains laying superintendent, has received the appointment of superintendent of mains to the Lancashire Electric Power Company.

Belfast.—Mr. Arthur King, Sheffield, has been appointed overhead construction superintendent to the Belfast tramways. Mr. King was formerly with the British Electric Equipment Company and in the Sheffield Corporation's tramways department.

Hammersmith.—Mr. Wm. R. Nice, of the Lancaster Corporation electricity works, has been appointed superintendent of the meter and testing department at the Hammersmith Corporation electricity works.

India.—Mr. Meares, electrical engineer, Bengal, has been appointed electrical adviser to the Government of India.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—

Consols: March 1st. General Settlements: February 10th, 24th, March 15th. Bank Rate, April 21st, 1904, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices
11,270	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2½— 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4½— 5
3,210,000	1	2/6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 5/16 - 3 7/16
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜ — 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 —104
£100,000	100	4½%	Aveling and Porter, Ltd, 4½% Reg Mt. Debs. Red.	100	96 — 99
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord. ..	1	3½— 3⅝
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1½— 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — 5½
250,000	1	6½d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 —103
150,000	4½	2/8½	Barrow Hæmatite Steel Co., Ld., O.	4½	1 9/16 — 1 11/16
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	4⅜ — 4¾
83,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares .. .	5	4¾— 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	-	100 —102
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11⅝ - 11⅞
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99 —101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	[illegible] 11/16
300,000	1	6½d.	Do. 5½% Cum Pref.	1	[illegible]
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	94 — 97
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1 — 1 1/16
1,860,900	1	3½d.	Do. Nos. 1,639,101-3,500,000	12/-	[illegible]
1,160,000	1	1½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1¼ — 1⅜
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	[illegible]
74,000	10	5/-	Do. 5% Cum. Pref.	10	11¼— 11¾
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord. ..	5	8½— 9
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5⅜— 5⅝
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	[illegible] 1 1/32
70,000	5	2/6	Do. 5% Cum. Pref.	5	5¼ — 5½
£250,000	Stk	4%	Do 4% 1st Mort Db. Stk. Red	100	100 —102
100,000	10	30/-	Consett Iron Co., Ltd., Ord.	7½	32 — 33
57 031	10	10/-	Crossley, Bros, Ld, Ord 40340/97370	10	16¼ 16¾
40,339	10	5%	Do 5% Cum Pref.	10	11½ 11¾
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2⅛ — 2¼
1,259,594	1	3½d.	Dorman, Long & Co., Ltd.	1	[illegible]
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating ..	5	3¼— 3½
250,000	1	9¾d.	Dunlop (James) & Co., Ltd., Ord...	1	⅝— ¾
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	[illegible] - 1 1/16
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9 — 10
69,754	13	12/-	Do. do. do.	10	7¼ — 8
20,250	10	8/-	Elliott's Metal, Ltd.	8	4½ 5½
5,000	10	5%	Do. Cum. Pref. 5% .. .	10	8¾— 9¼
186,748	Stk	4%	Do. Deb. 4%	100	91½ — 96½
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	10½— 11
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	97 —100
9,000	10	10%	Fleming & Ferguson, Ltd, Ord. Nos. 1/9000..	10	12 12¼
6,000	10	5%	Do. 5% Cum Pref. Nos. 9001/15000	10	9¼ 9⅞
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	4⅜ 4⅝
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5¾ 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	90½ 91½
16,800	10		Greenwood & Batley, Ltd., Ord. ..	10	
9,600	10	7%	Do. 7% Cum. Pref.	10	
965,000	1	10%	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2¼ 2½
344,000	5	2/6	Do. 5% Cum. Pref.	5	5½ 6⅛
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 —107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2 — 3
250,000	1	1/-	Hadfield's Steel F'dry Co., Ld., Ord.	1	3⅜— 3½
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½— 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5 - 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	1 5/16— 1 7/16
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	11 11¼
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	4¾— 5¼
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	⅞—
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¾ 5
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5¾ 6¼

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	1 11/16 —1 13/16
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12¼ - 12¾
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 —101
37,500	10	20	Kynoch, Ltd.	10	19 — 20
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅞ 11⅛
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	⅝— ⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1½	Leeds Forge Co, 7% Cum. Pref. ..	3	3¼ — 4¼
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16 — 1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11 — 11½
210,000	1	6d.	Measures Bros., Ltd, Ord.	1	11/16— 13/16
75,000	1	6½d.	Do. 5½% Cum. Pref.	1	13/16 - 15/16
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	94 — 97
21,943	5	2/6	Muntz Metal, Ltd.	5	5 5¼
14,248	5	5%	Do. Pref. 5%	5	5⅛ 5¾
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	74 — 76
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pt.	10	11⅞— 12⅛
80,000	5		North-Eastern Steel Co., Ltd., Ord.	5	-
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	2/-	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅞— 4⅛
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	5¾ — 6¼
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	9¼— 9¾
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97 —100
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm.P.	5	4¾ 5
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	3/6— 4/
13,000	5	—	Do. 5½% Cum. Pref.	5	2⅞ 3⅛
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅛ ⅜
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅞ - 2
73,062	5	2/-	Do. New	5	1½ - 1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	99 —102
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	⅞ — 15/16
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	94 — 96
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	9¼— 9¾
275,000	1	6d.	Scott (Walter), Ltd., Ord.	1	⅞— 1
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1— 1⅛
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs., Red ..	100	91 — 94
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	⅝ - 11/16
300,000	1	7½d	Do. 6% Cum. Pref...	1	13/16— ⅞
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	89 — 92
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	5½— 5⅝
£125,240	Stk	-	Do. 5% Trust Mort. Deb. ..	100	106½—107½
25,000	10	-	Stephenson (Robert) & Co., Ltd., Or.	10	2⅛— 2⅝
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	4½— 4¾
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	76 — 78
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	16¾— 17¼
55,000	10	6/-	Do. 6% Cum. Pref.	10	14¼— 14¾
634,732	1	4.69d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	⅞— 1
538,845	1	6d.	Do. 5% Cum. Pref.	1	15/16— 1 1/16
£240,000	Stk	4¼%	Do. 4¼% 1st Mort. Deb. Stk. Red	100	98 - 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ — [illegible]
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	67 — 71
£160,000	1	7½d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	15/16 - 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½— 10
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	31½— 31¾
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	97¾— 98¼
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	95 97
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord..	1	2 7/16 2 [illegible]
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1⅛ - 1¼
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	114 —117
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	105 —107
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	104 —106
225,000	1	1/2½	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	[illegible]
500,000	1	7½d.	Do. 6% Cum. Pref. Ord. ..	1	[illegible] 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	85 — 89
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4¼ 4¾
300	Stk	4½%	Do. Mort. Deb. 4½%	100	91 — 97
66,666	5	3/.	Willans & Robinson, Ord. . ..	5	1½ - 2¼
66,666	5	3/-	Do. 6% Cum. Pref.	5	3 — 4
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	74 — 79
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	81 — 86

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝ — ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	$\frac{7}{16}$ — $\frac{9}{16}$
120,000	1	9⅗d.	Bell's Asbestos Co., Ltd.	1	$\frac{11}{16}$ — $\frac{13}{16}$
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5¼ — 5¾
100,000	5	3/-	Do. 6% Cum. Pref.	5	5 —5¼
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	101 —103
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref. ..	5	2½ — 2¾
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	86 — 88
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	⅜ — ⅝
150,000	2	2 4⅘	Do. 6% Pref.	2	1¼ — 1½
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	93 — 96
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	75 — 78
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	9½ - 10
40,000	5	2/6	Do. 5% Cum. Pref.	5	5¼ - 5½
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	105 —107
85,000	3	1/6	Crompton & Co., Ltd...	3	2¼ — 2½
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	93 — 98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	8 — 8½
61,000	5	3/-	Do. 6% Cum. Pref.	5	5¾ — 6
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	105 —108
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	⅝ — ⅞
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1 — 1½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	77 — 82
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 — 84
112,100	2	1 7⅕	Electric Construction Co., Ltd. ..	2	1⅛ — 1¼
31,390	2	2 9⅗	Do. 7% Cumulative Pref. ..	2	2¼ 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99
10,248	10	7/6	Evered and Co., Ltd...	10	13 15
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 95
£25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	10¾ — 11¼
35,000	5	2/3	Do. 4½% Cum. Pref... ..	5	5⅛ — 5⅜
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	110 —112
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15 — 16
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	99 —102
7,500	10	–	Parker, Thos., Ltd.	10	6½ — 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/-—16/6
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	38 — 40
£150,000	100	4%	Do. 4% Deb. Bonds	100	101½-103½

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅜ — 8⅝
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅝ - 5⅞
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	11¾ — 12¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 -- 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 --102*
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 —100*
75,606	1		Bath Elec. Trams. Ld., Pf. Or. ..	1	$\frac{11}{16}$ — $\frac{13}{16}$
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	$\frac{15}{16}$ 1$\frac{1}{16}$
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1¼ — 1¾
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾ — 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	100 —103
		%	Pref. Ord. Stock	100	100 —103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¼ — 9¾
156,437	10	6/-	Do. 6% Cum. Pref.	10	11⅛ — 11⅝
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	119 —121
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	97 — 99
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3⅞ - 4⅛
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5¾ 6
27,000	5	3/-	Do. "B" do.	5	5½ — 5⅝

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	94 — 97
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	99 —102
102,268	5	3/-	Calcutta Tramways Co., Ltd. ..	5	8⅞ — 9⅛
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 —108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅜ — 1⅝
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞ — 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 —104
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13 — 14
59,987	10	6/-	Do. 6% Pref...	10	15½ — 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3¼ — 3¾
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	90 — 93
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10⅜ — 10⅝
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	104 —106
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	101 —103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	$\frac{15}{16}$ — [illegible]
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	⅞ — 1⅛
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	104 —106
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ — 1½
110,923	8	2/9¾	North Metropolitan Tramways Co..	8	4¾ — 5¼
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 9[illegible]
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	102 —105
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	8½ — 9½
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	99 —102

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares.	Last Dividend	Name	Paid up.	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12 — 12½
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9½ — 10
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	104 —106
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ — 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 —104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10½ — 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	10¼ — 10¾
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	8⅞ — 9⅛
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	8¼ — 8¾
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5⅝ — 5⅞
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	101 —103
44,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6¾ — 7¼
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 —110
70,595	10	5/-	City of London El. Lghtg. Co., Ld., O.	10	12 — 12½
40,000	10	6/-	Do. 6% Cum. Pref.	10	13½ — 14
£400,000	Stk	5%	Do 5% Deb. Stk., Red ..	100	122 —126
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	102 —104
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9 — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	108 —111
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	6¼ — 6½
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
19,000	5	2/-	Folkestone Elec. Supply Co., Ld., O.	5	5½ — 6
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10		Havana Electricity Co., Ltd... ..	10	9½ — 10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7½ — 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—102
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	$\frac{9}{16}$ — $\frac{11}{16}$
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	13 - 13½

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	—	London Elec. Supply Corp., Ld., Ord.	3	2⅜ — 2⅝
60,000	5	3/-	Do. 6% Pref.	5	5⅜ — 5⅝
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	96 — 98
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	18 — 18½
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅜ — 5⅝
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	96 — 98
£250 000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	94 — 97
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½— 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	102 —104
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6½— 6¾
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —102
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¾—14¼
20,000	5	3/6	Do. 7% Pref...	5	8½— 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2¾— 3¼
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	83 — 87
65,000	5	3/-	South London Elec. Sup. Co., Ltd. O.	5	4¼— 4½
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	1⅜ — 1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	5 — 5¼
30,000	5	2/6	Do. 5% Cum Pref. ..	5	5 1/16—5 3/16
£200,000	Stk	—	Do. 4½% 1st Mort. Deb. Stk. Red	100	105 —107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	13 — 13½
28,151	5	2/6	Do. 5% Cum. Pref.	5	6 — 6½

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	-	Amazon Telegraph Co., Ld... ..	10	1 — 1½
£763,580	Stk	12/6	Anglo-American Tel. Co., Ltd., Ord.	100	58 — 60
£3,118,210	Stk	25/-	Do. 6% Preferred Ordinary	100	105 — 107
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	12¼ - 12½
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅛ — 6⅜
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 —190
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	95 — 97
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾ — 9¼
6,000	10	10/-	Do. 10% Preference	10	16½— 17½
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜ - 3⅝
		5/-	10% Cum. Preference	5	7¼ — 8¼
£30,000	50	4½%	Do. 4½% Debs...	50	100-102%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11 —11½
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	99 —101
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	99 —101
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	100-102%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13½— 14
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	104 106
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	135 138
£2,000,000	Stk	17/6	Do. 3½% Pref.	100	87 — 89
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	105 —107
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	29¾ - 30¼
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	99 —101
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	45 — 47
72.680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	13/16 - 15/16
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	108½ 109½
£1,966 667	Stk	5%	Do. Deferred	100	108—110
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5¼ - 5½
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	96 — 98
£689,593	Stk	4%	Do. 4% do. do. ..	100	101½—103½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1 — 1⅛
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛— 1¼
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	96 — 99
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7 — 7½
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	6¾ - 7¼
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 - 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	105—107
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	7¼— 7¾
£30,008	2½	—	West Coast of America, Ltd. ..	2½	[illegible]
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	99 — 101

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅝ — ¾
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	7¼— 7¾
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6¾— 7¼
£80,000	100	5%	Do. 5% Deb.	100	101 —103
207,930	10	3/-	Western Telegraph Co., Ltd.	10	13½— 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	100½—102½

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8½— 9
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99 —101
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	93 — 95
10, 000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 - 6½
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	73 — 76
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	98 —100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	13¾— 14¼
40,000	20	8/-	Do. Nos. 60,001-100,000	10	6 — 6½
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1⅛— 1¼
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4¼— 4¾
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	7¼— 7¾
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	97 — 99
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	3 — 3½
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3¼ - 3¾
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 — 86
141,500	10	5/-	Leyland (Fredk.), & Co., (1900), Ltd., 5% Cum. Pref. ..	10	4½— 5
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	126 —129
£1,160,000	Stk	19%	Do. do. Deferred ..	100	218 —221
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	26 — 27
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8 — 8½
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	9¾— 10¼
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	99 —101

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
60,000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	⅞— 1⅛
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	138 —143
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	5/16— 7/16
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	9/16— 11/16
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16— 1 3/16
135,000	1	7⅕d.	Do. 6% Cum. Pref. ...	1	1⅛— 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

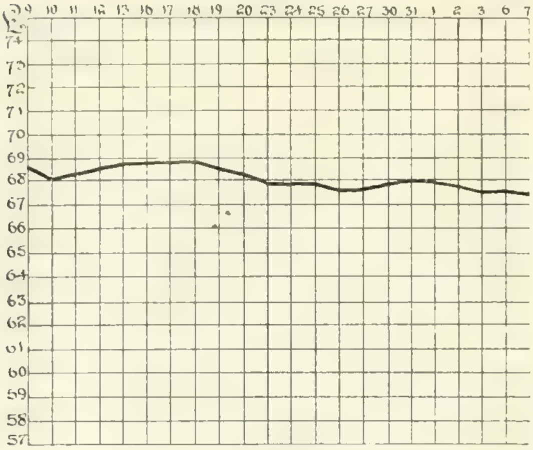
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	21¼— 21¾
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¼— 8¾
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 — 13½
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9 — 9½
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 — 4½
14,567	10	1/3	Lancashire Wagon, Ord.	2	2 7/16 2 9/16
4,150	10	5%	Do. do.	10	10¼ 10¾
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	41 — 42
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/6 24/6
235,000	1	7⅕d.	Do. Cum. B Pref. 6% 1-235,000	1	28/3 28/9
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 — 20

Stocks and Shares marked * are quoted ex-dividend.

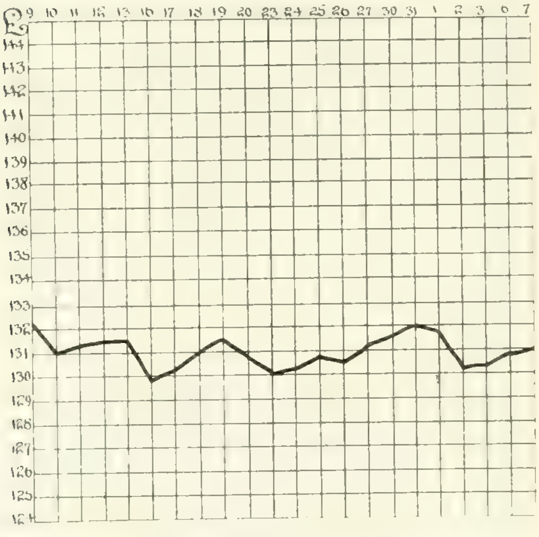
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JANUARY 9TH TO FEBRUARY 7TH, 1905

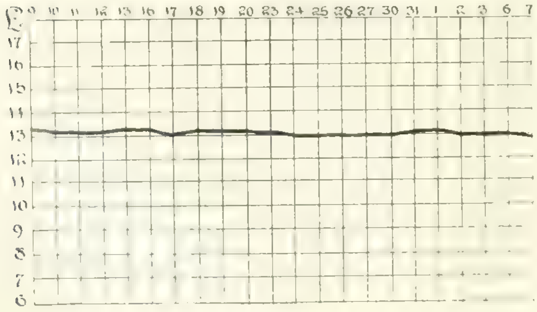
COPPER.



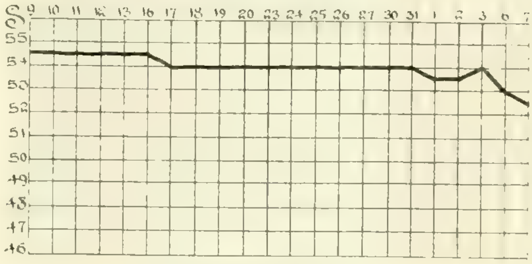
TIN.



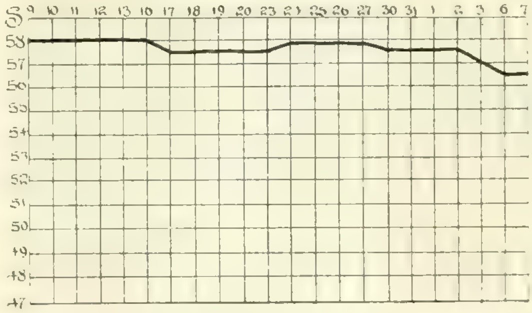
ENGLISH LEAD.



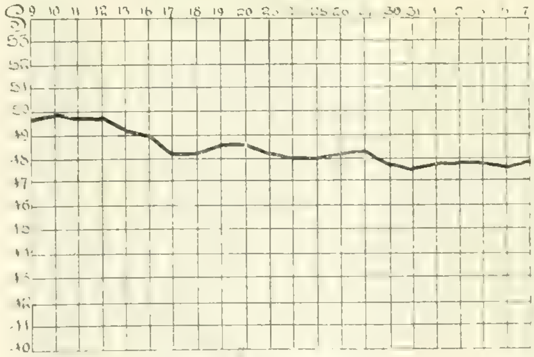
PIG IRON: SCOTCH,



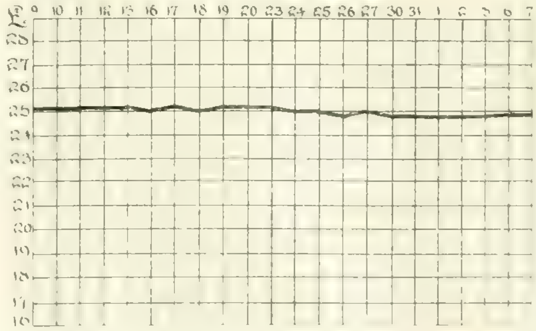
HEMATITE,



CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, February 8th, 1905.

COPPER has been weaker, although on balance quotations show little alteration. There has been practically no change in the statistical position, but less sanguine views of the future of the metal are prevalent, it being argued that the advance in price during the past three months has gone a long way to discount the good position. Messrs. Merton and Co.'s circular does not reflect this view. It is pointed out that consumers here as well as abroad have again been buying for immediate requirements, with the result that in metal for early delivery the market is rather short. The position is one where the task of predicting the future course of quotations is a difficult one, but an advance in the price of the metal appears probable.

Tin has been an active market. With scarcity in New York there has been some good American buying of prompt metal, with the result that quotations advanced to an extent which checked buying orders. A break in the market followed, but was to some extent stayed by the satisfactory statistics. The price receded again yesterday.

Lead has exhibited few features of interest. At the beginning of the week there was a tendency to firmness owing to the absorption of spot parcels, but quotations eased off when consumers had satisfied their immediate requirements. The closing prices are £12 12s. 6d. foreign and £12 17s. 6d. English.

The market for Spelter is a shade easier, the result of slower inquiries, but the labour trouble in Silesia is regarded as a bull point and a recovery appears imminent.

In the Iron and Steel section, the speculative markets in London and Glasgow have been active but prices have receded on balance, operators being in a realising mood. Poor shipments and the growing stocks in public stores have been the main causes of speculative sales. The reports from trade centres are not however unsatisfactory. At Barrow there are indications of a revival in the hematite trade, and Glasgow reports the steel trade more active on the revival in shipbuilding. At Birmingham the tone is steady, and Sheffield correspondents, while reporting continued inactivity in iron, give a good account of the heavy steel trade.

Coal shows an improved tone, more satisfactory reports coming to hand from both Cardiff and Newcastle.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

	£	s.	d.
Steel:			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
,, ,, ,, Land ,, ,,	6	17	6
,, ,, ,, Ship Quality Plates	5	17	6
Siemens' Steel Bars, Boiler Quality	6	17	6
,, ,, ,, Ship ,,	6	7	6
,, ,, Angles	5	7	6
Manufactured Iron:			
Bars—Dalzell	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

	£	s.	d.	
Steel Angles (Glasgow ♛ Steel)	5	8	9	per ton.
Steel Ship Plates (Glasgow ♛ Steel)	5	18	9	,,
Steel Bars, Ship Quality (Glasgow ♛ Steel)	6	8	9	,,
Steel Bars, Boiler Quality (Glasgow ♛ ♛ Steel)	6	18	9	,,
Steel Land Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quotes:—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix			
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1. £	s.	d.	No. 3. £	s.	d.
Coltness, f.a.s. Glasgow	3	5	0	2	15	0
Gartsherrie ,,	2	19	6	2	14	6
Summerlee ,,	3	0	6	2	15	0
Carnbroe ,,	2	17	6	2	14	0
Langloan ,,	3	4	0	2	16	0
Calder ,,	2	19	0	2	14	6
Clyde ,,	2	19	0	2	14	6
Glengarnock, f.o.b Ardrossan	2	19	0	2	13	6
Eglinton ,, ,,	2	15	6	2	13	0
Dalmellington, ,, Ayr	2	15	6	2	13	0
Shotts ,, Leith	2	19	0	2	14	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♔ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby ♔	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♔ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8 inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron. £	s	d.	Steel. £	s.	d.
Crown (BNF) Bars	6	10	0	7	5	0
,, ,, Angles	7	0	0	7	5	0
,, ,, Tees	7	10	0	7	15	0
,, (WIW) Hoops	7	0	0	7	10	0
,, ,, Sheet	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets:	Singles 20 G 96in. by 36in. per ton. £	s.	d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton £	s.	d.	Doubles 21 to 24 G to 96 by 36in. per ton. £	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th inst

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	15	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	7	6	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	15	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	..
,, ,, Best Best	9	5	0	..
,, ,, Treble	10	5	0	..
Plates	7	10	0	..
Best Plates	8	0	0	..
,, Boiler Plates	8	10	0	..
,, Best Boiler Plates	9	10	0	..
Treble Best Boiler Plates	12	0	0	..

Delivery f.o.b. Liverpool, Birkenhead or Manchester

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

Coke Tin-plates.	Per Box. f.o.b. Wales. £	s.	d.
C 18¼ by 14 124s. 110 lb "BV"	0	13	0
C 20 by 10 225s. 155 ,, "Jumbo"	0	18	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	6
C 28 by 20 112s. 216 ,, "Lydbrook"	1	5	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	13	3

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d	
Blooms	at 3	12	0	per ton.
Billets	at 3	14	0	,,
Sheet Bars	at 3	16	0	,,
Finished Steel:				
Bars	at 5	0	0	per ton.
Angles	at 5	1	0	,,
Tees	at 5	1	0	..
Joists	at 4	10	0	,,
Fencing Standards	at 5	2	0	..
Shoeing Bars	at 5	4	0	,,
Tyre Bars	at 5	4	0	,,
Half-Round Bars	at 5	5	0	,,
Heavy Rails	at 4	15	0	..
Light Rails	at 4	17	6	..

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. ... Dis. 1¼%, & 1%	131	10	0	to	132	0	0	per ton.
English Bars, f.o.b. Dis. 1¼%, & 1%	132	10	0	to	133	0	0	..
Straits G.M.B., cash Warehouse, Net	130	17	6	to	131	0	0	..
Straits G.M.B., 3 months, Warehouse, Net	129	17	6	to	130	0	0	..
Australian, Mr. Bischoff, Warehouse, Net	131	7	6	to	131	10	0	..

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	67	6	3	to	67	7	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	67	11	3	to	67	12	6	,,
English, Tough, Cake & Ingot, Warehouse, Net	70	0	0	to	70	10	0	..
English, Best Select, Warehouse Net	70	15	0	to	71	5	0	..
English, Sheets and Sheathing, f.o.b., Dis. 2½%	80	0	0	to	80	10	0	..
English, Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex. ship	0	12	0	to	0	13	0	per unit
Regulus, Matte and Precipitate, ex. ship,	0	13	3	to	0	14	0	,,

YELLOW METAL.

Yellow Metal:	£	s	d.	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%				0	0	6¼	per lb.
Sheathing ,, ,,				0	0	6¼	..

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	15	0	to	25	0	0	per ton.
Blende of 50%, Net	6	16	6	to	7	0	0	..
Calamine, Net	6	19	0	to	7	0	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis 2½ ..	12	17	6	to	13	0	0	per ton.
Spanish, ex ship, Dis. 2½%	12	12	6	to	12	15	0	..
Lead Ore of 70%, Net	6	10	0	to	6	12	6	..

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½	36	0	0	to	37	0	0	per ton.
Ore, 50%, ex ship, Dis. 2½	8	0	0	to	9	0	0	..
Crude, ex ship, Dis. 2½	13	10	0	to	14	0	0	..

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	12	6	per flask.
Italian ,, ,, ,,	7	11	6	..

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1″ to 2″)	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

Steam.	s.	d
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.

High Hazel.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in. cube	5	6

Steam.—Top Hard.		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb
Picric, Crystals	0	0	11	,,
Tartaric at Manchester	0	0	10⅞	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	9	10	0	per ton.
Grey ,,	11	10	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	24	0	0	per ton.
Sal-ammoniac, Lump, 1sts, del^{d.} U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	13	2	6	,,
Arsenic: Best White Powdered net	12	5	0	,,
Bleaching Powder, 35% ,,	4	10	0	,,
Borax: British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:				
Benzole, 50/90 % ,,	0	0	8¾	per gal.
,, 90% ,,	0	0	10	,,
Carbolic Acid Crystals, 34/35° C. ,,	0	0	6⅞	per lb.
,, ,, ,, 39/40° C. ,,	0	0	7⅛	,,
,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	2	0	,,
Creosote, ordinary good liquid ,,	0	0	1¼	,,
Naphtha, Crude, 20% at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8½	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9½	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10½	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b. ,,		1	0	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	12	0	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake ,,	1	2	6	,,
Copper: Sulphate	22	5	0	,,
Cyanides: 98% minimum f.o.b. net	0	0	8	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	24	5	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	17	0	0	,,
Nitrate	24	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,
Potash: Bichromate... delivered England	0	0	3	per lb.
Carbonate, 90/92 % c.i.f Hull	18	0	0	per ton.
Caustic, 75/80 % ,, ,,	20	10	0	,,
Chlorate net	0	0	$3\frac{1}{16}$	per lb.
Montreal in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow net	0	0	$4\frac{15}{16}$	per lb

	£	s.	d.	
Soda: Ash, Caustic, 48 %, Ordinary ... ,,	5	5	0	per ton.
,, ,, ,, Refined...... ,,	6	5	0	,,
,, Carbonated, 48 %... ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali) ......net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % ...... net	6	10	0	,,
Caustic, White, 77 %...... ,,	10	10	0	,,
,, ,, 70 %...... ,,	9	12	6	,,
,, ,, 60 %...... ,,	8	12	6	,,
,, Cream, 60 %...... ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate ...... c.i.f. Hull net	16	10	0	,,
Bicarbonate, in 1 cwt. kegs	6	15	0	,,
Bichromate......delivered England...	0	0	2¼	per lb.
Chlorate ...... net	0	0	$3\frac{1}{16}$	per lb
Nitrate...ex quay Liverpool, ... ,,	11	7	6	per ton.
Phosphate	9	5	0	,,
Prussiate ......net	0	0	3⅝	per lb.
Silicate, Solution, 140 Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)......	1	12	6	,,
,, (Saltcake, 95%)......	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers	7	10	0	,,
Zinc: Sulphate	6	15	0	,,

MINERALS.

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports......	3	7	6	,,
Manganese: Lump c.i.f. Liverpool 10¼d.				per metallic unit.
Ochre: French JC ...... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk)......c.i.f. Liverpool	3	10	0	,,

OILS, etc.

	£	s.	d.	
Aniline Oil ......net	0	0	4¾	per lb.
,, **Salt**...... ,,	0	0	4½	,,
Castor Oil: French, 1st pressure, f.o.b. Marseilles less 1¼%......	22	5	0	per ton.
English, 1st pressure, f.o.r. Hull, less 2½%......	24	0	0	,,
Cocoa Nut Oil: Ceylon, ex store Manchester......net	29	10	0	,,
Cochin, ex store Manchester ......net	32	0	0	,,
Cotton Seed Oil: Refined at Hull, less 2½%, naked	12	15	0	,,
Edible...at Hull, less 2½% naked	13	5	0	,,
Glycerine: Crude, 80% ......net	31	0	0	,,
Linseed Oil: Raw... ..at Hull, less 2½% naked	12	15	0	,,
Boiled......at Hull less 2½% naked	13	15	0	,,
Starch: American Pearl...at Manchester, net	9	0	0	,,
Dextrine...... ,, ,,	18	0	0	,,
Farina...... ,, ,,	15	15	0	,,
Shellac: Standard TN orange spot		155/		per cwt.
March delivery		140/-		,,
Turpentine: American...... ..at Liverpool	38	10	0	per ton.
Russian ......at Hull...net	19	0	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine......	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	0
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	3	10
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks......	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do. ...	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	15	0		7	5	0
Lower Ports Spruce......	,,	6	10	0		6	15	0
Spruce Boards......	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	0	11		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak......	per load	12	0	0		16	0	0
Greenheart......	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak......	,,	0	2	6		0	3	0
Norway Spars......	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

21,508a. J. Barr, Glasgow. Jan. 25.—Improvements in torpedoes. (Date applied for Oct. 7th, 1904.)

29,651a. H. Cruse, Manchester. Jan. 26th.—Improvements in joints between the tubes and drums of water-tube steam generators. (Date applied for Dec. 31st, 1904.)

1905.

1234. J. J. Rawlings and Rawlings Bros., Ltd., London. Jan. 23rd.—Improved pipe-bending machine.

1235. J. B. Brooks and J. Holt, Birmingham. Jan. 23rd.—Improvements in adjustable spanners and wrenches.

1267. O. Brunler and G. Kettler, Germany. Jan. 23rd.—Steam carbonic acid engine.

1268. W. G. Stoneham, Windsor. Jan. 23rd.—Improvements in the manufacture of kettles, saucepans, jacket-pans, boilers, and all vessels for heating liquids or solids.

1269. C. A. Allisson, London. Jan. 23rd.—Reversible current apparatus for steam condensers. (*P. Barnes and C. H. Chandler, U.S.A.*)

1271. A. Reimann, London. Jan. 23rd.—Method of insulating hot-water reservoirs, boilers, steam-pipes, and the like.

1282. A. C. F. Dann, London. Jan. 23rd.—Improvements in change speed gear.

1291. R. H. Lewis, London. Jan. 23rd.—Centrifugal speed regulator.

1294. A. Smart, London. Jan. 23rd.—Improvements in Corliss and like valve gear.

1296. A. J. Boult, London. Jan. 23rd.—Governing mechanism for engines. (*Woolley Foundry and Machine Works, U.S.A.*)

1302. K. E. Hiller, London. Jan. 23rd.—Improvements in or relating to pneumatic riveting machines or the like.

1303. A. J. Boult, London. Jan. 23rd.—Improvements in or relating to valve devices for use in hydraulic and other high pressure apparatus. (*J. McGillivray, U.S.A.*)

1305. A. A. Rosengrèn, London. Jan. 23rd.—Improvements in automatic couplings for railway cars.

1311. M. Castelnau, London. Jan. 23rd.—Improvements in the lubrication of engine pistons and cylinders. (Date applied for Feb. 9th, 1904.)

1323. A. S. Hyde, London. Jan. 23rd.—Improvements in apparatus for bending pipe.

1338. H. L. Williams, Derby. Jan. 24th.—A new or improved method of excavating specially though not exclusively applicable for taking up a road surface of concrete macadam or the like.

1341. J. Dean, Bradford. Jan. 24th.—Improvements in and relating to hot air tentering machines.

1342. D. W. F. Maxwell, London. Jan. 24th.—Improvements in and relating to metal turning and boring lathes.

1347. J. H. Mann and Mann's Patent Steam Cart and Wagon Co., Ltd., Leeds. Jan. 24th.—Improved method and means for filling steam carts, wagons, and the like.

1353. H. L. Wethered, G. C. Gardiner and B. Wild, Bristol. Jan. 24th.—Improvements in boiler settings.

1361. J. Williams, Denaby-Main. Jan. 24th. [illegible] and steam producer.

1373. H. Casler, London. Jan. 24th.—Lubricator.

1382. W. H. Harker, A. T. Allcock, and J. W. Cable, London. Jan. 24th.—Improvements in or relating to deep-boring machines or apparatus.

1388. W. J. Lloyd and W. Priest, London. Jan. 24th. A new or improved [illegible] combustion engines.

1395. J. Roemer, London. Jan. 24th. Improvements in and relating to wrenches.

1396. J. A. Siferd, London. Jan. 24th.—Improvements in and relating to railway ties.

1397. D. N. Baxter, London. Jan. 24th.—Improvements in and relating to feed-water purifiers for boilers.

1402. E. Guillemaud Fils, London. Jan. 24th.—Improved mechanism for the automatic lubrication of vertical spindles.

1405. L. Serne, J. E. Lafontaine and C. K. Tollenaar, London. Jan. 24th.—Improvements relating to furnaces for steam generators.

1414. A. C. H. Winterflood, London. Jan. 24th.—Improvements in or connected with automatic valves for water heaters and the like.

1427. L. E. Stetler, London. Jan. 24th. (Date applied for, Feb. 1st, 1904).—Improvements in rotary engines.

1434. W. Bueb, London. Jan. 24th.—Improvements in or relating to water-gas generators.

1440. J. H. Willis, Northwich. Jan. 25th.—Improved anti-vibratory spring suspension bearing.

1452. F. Thomas, Manchester. Jan. 25th.—Improvements in tools for boring, turning, and otherwise cutting metals, and for certain other purposes.

1459. W. Badger, jun., Rotherham. Jan. 25th.—An automatic movable jumper-iron machine for use in cable haulage and aerial railways.

1472. W. J. Greaves. Jan. 25th.—Improvements in steam generators.

1478. H. Collet, London. Jan. 25th.—An improved method of supporting shafting.

1523. W. P. Thompson, Liverpool. Jan. 25th.—Improvements in gas engines. (*The Free Piston Gas Engine Co., U.S.A.*)

1525. H. F. Fullagar, London. Jan. 25th.—Improvements in or relating to apparatus for governing steam turbines and other steam engines.

1547. J. Wood, Manchester. Jan. 26th.—Improvements in and connected with continuous open fabric steaming apparatus.

1548. W. Denton, London. Jan. 26th.—A flexible steel-rope appliance for the safe working and navigating of steam ferries during fogs or at any other time.

1556. J. Cleland and J. C. Stewart, Belfast. Jan. 26th—Improvements in steam traps.

1581. W. H. Trewartha-James, London. Jan. 25th.—Improvements in grinding mills.

1600. W. R. Dawe, London. Jan. 26th.—Rotary engine.

1603. P. Hulburd, London. Jan. 25th.—Improvements in metal packing for flange and other joints.

1623. G. W. Hughes, Liverpool. Jan 27th.—Improvements in safety appliances for hoisting cages.

1626. G. A. Tillé and L. E. Baumann, Manchester. Jan. 27th.—Improved pump. (Date applied for Jan. 20th, 1904.)

1641. J. Phythian and A. E. Berry, Huddersfield. Jan. 27th.—Improvements in grooving machines.

1642. J. K. Broadbent, Manchester. Jan. 27th.—Improvements in the fire-bars of furnaces for steam generators and the like.

1657. C. Joly and C. C. H. Millar, London. Jan. 27th. Improvements in and connected with single rail and like railways and tramways.

1669. A. J. Hill, London. Jan. 27th.—Combined pneumatic turbine and speed reducing gear for [illegible] other rotary apparatus.

1672. H. H. Lake, London. Jan. 27th.—Improvements in and relating to machines for making rivets. (*C. J. Da Costa, U.S.A.*)

1716. H. N. Bray and J. Massey, Manchester. Jan. 28th.—Improvements in or applicable to valves.

1723. F. Lobnitz, Glasgow. Jan. 28th.—Improvements connected with apparatus for breaking up or cutting rocks, stones or earth under water, or on dry land.

1728. J. Cleland and J. C. Stewart, Belfast. Jan. 28th.—Valves for steam or other fluid pressures.

1734. M. F. M. Mulready, and E. M. Mulready, London. Jan. 28th—Improvements in gas engines and the like.

RECENT SPECIFICATIONS.

STEAM TURBINES.

Willans and Robinson, Ltd., and M. H. P. Sankey, of Rugby. March 11th, 1904.—Refers to fixing the blades of a turbine. According to this invention, the blades are not fixed to the segment but are held between the side of the groove and the side of the segment by the pressure caused by the caulking ring. For this purpose the ends of the blades are stamped or otherwise formed to a right-angled, or approximately right-angled section or tang, one side of the right angle entering a slot in the segment, whilst the other lies flat against the side of the segment. The grooves and segments are preferably both of a dovetailed form, as has before been proposed, and according to this invention, that side of the right-angled tang which lies between the side of the segment and the side of the groove is also preferably dovetailed, the metal being thickest at the extreme end of the blade. The slots in the segments and the other side of the right-angled-shaped tang may also be dovetailed, the latter being broadest at their extreme ends. The sides of the grooves may be circumferentially corrugated to give a better hold on the blades. One side of the right angled tang may be longer than the other, the other being cut off in the stamping process, and the longer part may be bent up at right angle, so as to lie upon the underside of the tang and so make the dovetailing effect more pronounced.

Fig 1

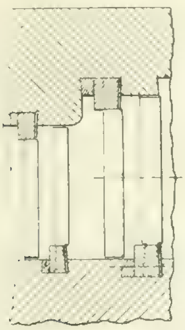


Fig 5

Fig 4

Fig 2

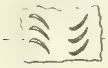
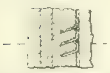


Fig 3



STEAM GENERATORS.

Glover's Water Tube Boiler Company, Ltd., and D. Crowther, of Leeds. March 1st, 1904.—This invention relates to an improvement in the means for attaching the ends of water tubes to other parts of steam generators, and more particularly to such, in which a junction box, casing or header, as it is variously called, is used for making the connection. The invention is described with reference to its application to secure the ends of water tubes, situated within the flue tube of a boiler, the end portion of the water tube being supposed to run longitudinally or parallel with the flue plate. A junction box is employed, having the end face, into which the end of the water tube is inserted at right angles to the flue plate and the side having the opening for communicating with the interior of the boiler, machined to the curve of the flue plate. This latter side of the junetion box is formed at both ends with a flange extending longitudinally. The object of this is, to obtain a greater base or leverage to resist any strains thrown on the joint. A boss is formed on the inner side of this joint face round the opening in it, and the opening is tapped to receive a short piece of piping, which serves as a bolt to secure the joint. A washer or plate is fitted against the inner or water side of the flue plate and made of a length and breadth equal to or somewhat greater than the length and breadth of the joint face of the junction box, and curved in the shorter direction to fit the curve of the flue plate, and is provided with a central opening to fit over the aforesaid pipe, whilst a nut on the end of said pipe draws the connection tight. Owing to the greater longitudinal extension of the joint face of the junction box, and of the internal washer and the comparatively large diameter of the screwed or bolt pipe, this connection is much less likely to become leaky, than is the case where a single central bolt is used to secure the connection.

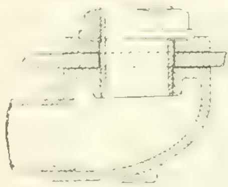


FIG 1

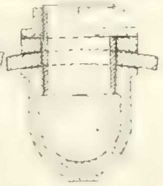


FIG 2

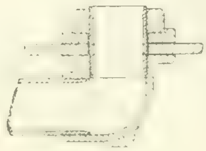


FIG 3

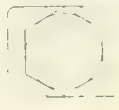


FIG 4

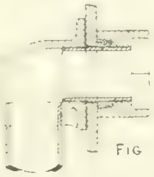


FIG 5

FIG 6

ROTARY ENGINES.

H. E. Parry, R. W. Thomson and W. J. Farley, of Perth, Western Australia. July 13th, 1904.—This invention of an improved reversible rotary engine consists in the employment of a rotary and circular piston working within an eleptical-shaped cylinder, and also in the peculiar arrangement of the central circular valve which proceeds into the bore of the piston and communicating with ports formed radially in the piston for the admission and exit of steam to and from each of the driving blades of the piston. It essentially consists in the means for independently or concurrently operating the valves and also in means for controlling the elliptical travel of the multiple blades, and for the simultaneous admission and exit of steam to and from opposite points of the piston, so allowing of an easy and instant reversal of the engine, and also of the use of the steam to its maximum expansive value.

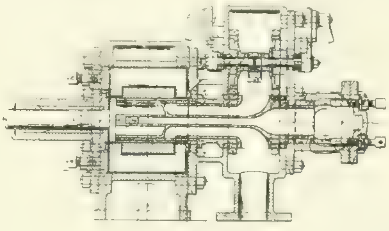


FIG. 1.

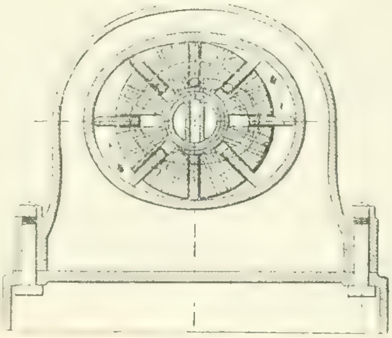


FIG. 2.

NEW PUBLICATIONS.

"GETTING GOLD."

A Practical Treatise for Prospectors, Miners, and Students. By J. C. F. Johnson, F.G.S. Charles Griffin and Co., Ltd. 3s. 6d.

It is quite obvious that this work is the outcome of many years' practical experience, and the need of such a book is emphasised by the rapid development of the gold-mining industry. After an informing introduction the writer addresses his remarks mainly to inexperienced prospectors, advising them upon a course of studies preparatory to their embarking on a "getting gold" expedition. He then discusses prospecting as conducted on alluvial fields, the origin of auriferous lodes, the mode by which in all probability the gold was conveyed to them and deposited as metal, and the derivation of gold in auriferous drifts. In the section devoted to Gold Extraction, the treatment of ores and matrixes for the extraction of the metal contained is dealt with. The following chapters are devoted to secondary processes and lixiviation, calcination of ores, motor power and its transmission. The author's pertinent remarks on company formation and operation are suggestive and to the point, but we think his "Rules of Thumb" will be more appreciated by his practical readers.

"THE PRACTICAL ELECTRICIAN'S POCKET BOOK, 1905."

Edited by H. T. Crewe, M.I.Mech.E. S. Rentell and Co., Ltd. 1s.

This handy and most useful little compilation has now reached its eighth year of publication ; the present issue has been thoroughly revised and enlarged, and in view of the increasing interest in alternating currents, a section has been added dealing with alternators. Additional matter bearing on steam turbines, patents, and wireless telegraphy has also been included, while all the old features which have rendered this pocket book indispensable to the practical man have been retained.

BOOKS RECEIVED.

Valves and Valve-Gearing. A Practical Text-Book for the Use of Engineers, Draughtsmen and Students. By Charles Hurst. Fourth Edition. With numerous illustrations. Charles Griffin and Co., Ltd. 10s. 6d.

The Universal Electrical Directory (J. A. Berly's). Containing a complete Record of all the industries directly or indirectly concerned with Electricity and Magnetism. Alabaster, Gatehouse and Co. 10s.

A class book of Naval Architecture : Practical, laying-off, Theoretical. By W. J. Lovett. Illustrated. Longmans, Green and Co. 7s. 6d.

Transactions of the North-East Coast Institution of Engineers and Shipbuilders. Vol. xxi. Parts 1 and 2. Andrew Reid and Co., Ltd.

We have also received : "Laboratory Notes on Practical Metallurgy," by Walter MacFarlane, F.I.C. (Longman's Green and Co., 2s. 6d.). A graduated series of exercises clearly demonstrating metallurgical principles ; eminently suitable for technical school students. "The Commission of H.M.S. *Fox*, East Indies Station, 1901-1904," by F. E. Nobbs and W. T. Berger (The Westminster Press, 4s.). We have previously called attention to this excellent "Log" series, the high standard of interest of former volumes is well maintained by the story of the *Fox*. "Astronomy without a Telescope," by E. Walter Maunders, F.R.A.S., illustrated by star maps and key diagrams (W. Thacker and Co.), a guide to the study of the constellations with the unassisted sight, written in a popular style, and calculated to awaken a more general interest in astronomy. "The Construction of Cranes and other Lifting Machinery," by Edward C. R. Marks, M.I. Mech.E., third edition (Technical Publishing Co., Ltd., 3s. 6d. net). Part I. discusses the general principles and practice in standard types of lifting machines; Part II. some patented inventions relative to lifting machinery ; Part III., examples of present practice by leading makers of lifting machinery illustrating the extensive and extending application of electrical energy to the operation of Cranes, etc. The illustrations are a strong feature of the work, which should be studied by every mechanical engineer.

NEW CATALOGUES.

In issuing their various pamphlets, The Fairbanks Company, of 78-80, City Road, E.C., adopt a practice which might with advantage be followed by other manufacturers of machinery. Their various pamphlets are of a uniform octavo size and are bound in an adjustable expansive cover which makes the pamphlets handy for reference and preserves them from dust. Pamphlets received from this firm deal with weighing machines, cement testing, arcade files, reed-pipe fitters' tools, new process hot forged twist drills, emery and corundum wheels, the Moran flexible joint, double-tube injectors, Yale and Towne chain blocks, power transmission appliances, the "Fairbanks" improved gas and oil engines, skinner chucks, and pipe-threading and cutting machinery.

A third edition of their interesting little brochure, "Notes on Electric Lifts," has been issued by Messrs. Archibald Smith and Stevens, of Janus Works, Queen's Road, Battersea. The first few pages of the work are devoted to an enumeration of the advantages and disadvantages of electric and hydraulic lifts. The nature of current available and the different systems of control are then discussed, and the last pages contain extracts from letters received by the firm from their customers. All the tables have been brought up to date.

Messrs. G. F. Smith, Ltd., of Paragon Ironworks, South Parade, Halifax, forward an illustrated and descriptive catalogue of improved and newly-designed machine tools for engineers, shipbuilders, boiler makers, etc.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, FEB. 10.—Physical Society : Annual General Meeting, Royal College of Science, Exhibition Road, South Kensington, 8 p.m. : Address by Professor J. H. Poynting, F.R.S., on "Radiation Pressure."—Royal Society, Albemarle Street, W., 9 p.m.—Royal Astronomical Society, Burlington House, W. : Anniversary Meeting, 5 p.m.—Tramways and Light Railways Association.—Annual Meeting Society of Arts, 8 p.m.—Institution of Civil Engineers, Students' Meeting, Great George Street, S.W. 8 p.m. : Paper, "The Reconstruction of the Santa Lucia River Bridge, Uruguay," by Mr. P. J. Risdon.—Institution of Mechanical Engineers : Students' Banquet, Empire Rooms, Trocadero Restaurant.

SATURDAY, FEB. 11.—North of England Institute of Mining and Mechanical Engineers, Newcastle, 2 p.m.—Manchester Association of Engineers : Annual Dinner, Grand Hotel, Manchester.—Junior Institution of Engineers : Coming of Age Dinner, Hotel Cecil, Strand, 7 p.m.

MONDAY, FEB. 13.—Society of Arts Cantor Lecture, 8 p.m. : "Internal Combustion Engines," Mr. Dugald Clerk, M.Inst.C.E., London Institution, 5 p.m. : Professor W. E. Ayrton, F.R.S., on "Energy : American, British and Japanese."—Institute of Marine Engineers, Stratford, 8 p.m.—Junior Institution of Engineers: Visit to Brockie Pell Arc Lamp Works, 6.30 p.m.

TUESDAY, FEB. 14.—Royal Institution, 5 p.m. : Paper, "Structure and Life of Animals," Professor Miall.—Manchester Steam Users' Association : Jubilee Banquet, Midland Hotel, Manchester, 7.30 p.m.—University of Liverpool Engineering Society : Paper, "Present Day Iron and Steel Works," Mr. F. J. Brislee, M.Sc.—Institution of Electrical Engineers, Glasgow Local Section, 8 p.m. : Paper, "Earthing," Mr. W. W. Lackie.—Manchester Local Section, 8 p.m. Paper "Tramways Power Supply," by Messrs. Pearce and Gunton.

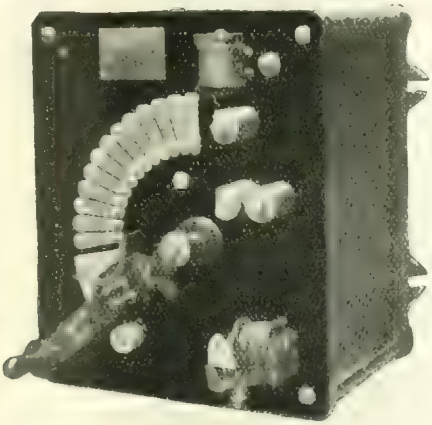
WEDNESDAY, FEB. 15.—Institution of Civil Engineers : Dinner by Sir Guilford Molesworth, President, to the Council and honorary members, 8 p.m.—Society of Arts : Ordinary Meeting, 8 p.m.—Institution of Electrical Engineers (Birmingham Local Section), 8 p.m.—Chemical Society.

THURSDAY, FEB. 16.—Royal Society, 4.30 p.m.—Royal Institution, 5 p.m. : Paper, "Recent Work of the Geological Society," Mr. J. H. Teall.—Society of Arts, 4.30 p.m. : Paper, "Indian Census of 1901," Sir C. A. Elliott.—Institution of Electrical Engineers (Leeds Local Section), 8 p.m.

FRIDAY, FEB. 17.—Geological Society : Anniversary Meeting, 8 p.m.—Chamber of Shipping : Meeting, Cannon Street Hotel, 11 ; Dinner, Hotel Metropole, 7 p.m.—Royal Institution, 9 p.m. Paper, "High-Power Microscopy," Mr. J. W. Gordon.—North-East Coast Institution of Engineers and Shipbuilders, Newcastle.

PAGE'S WEEKLY Miscellaneous

"ICRANIC"



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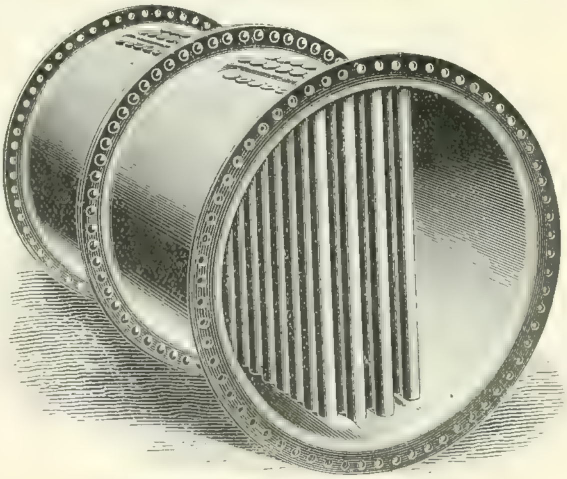

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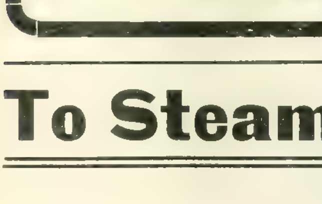

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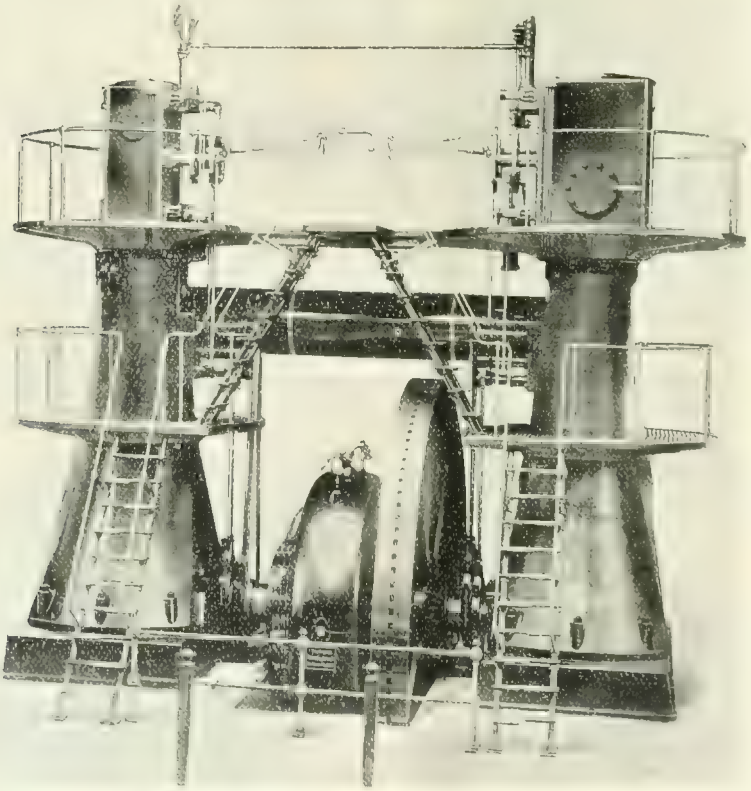

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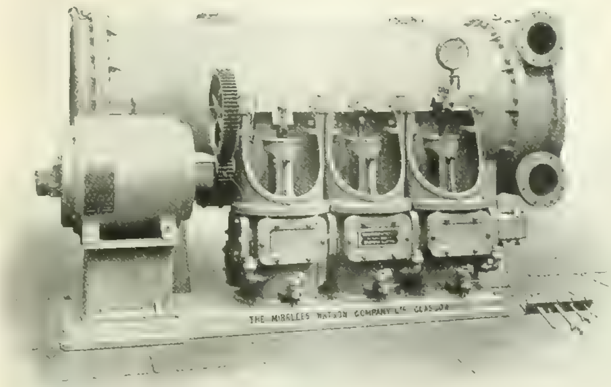

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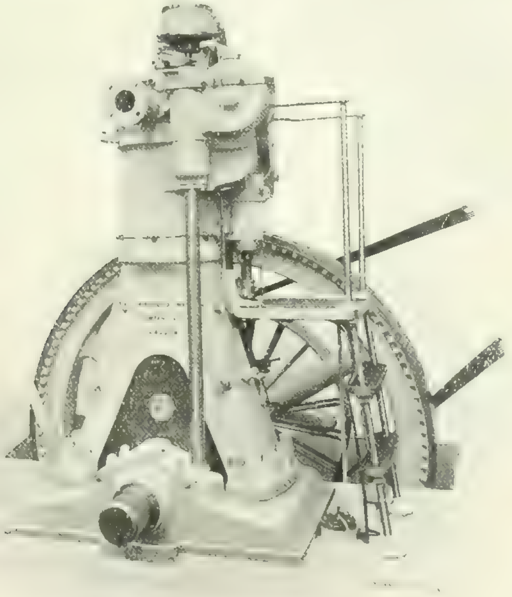

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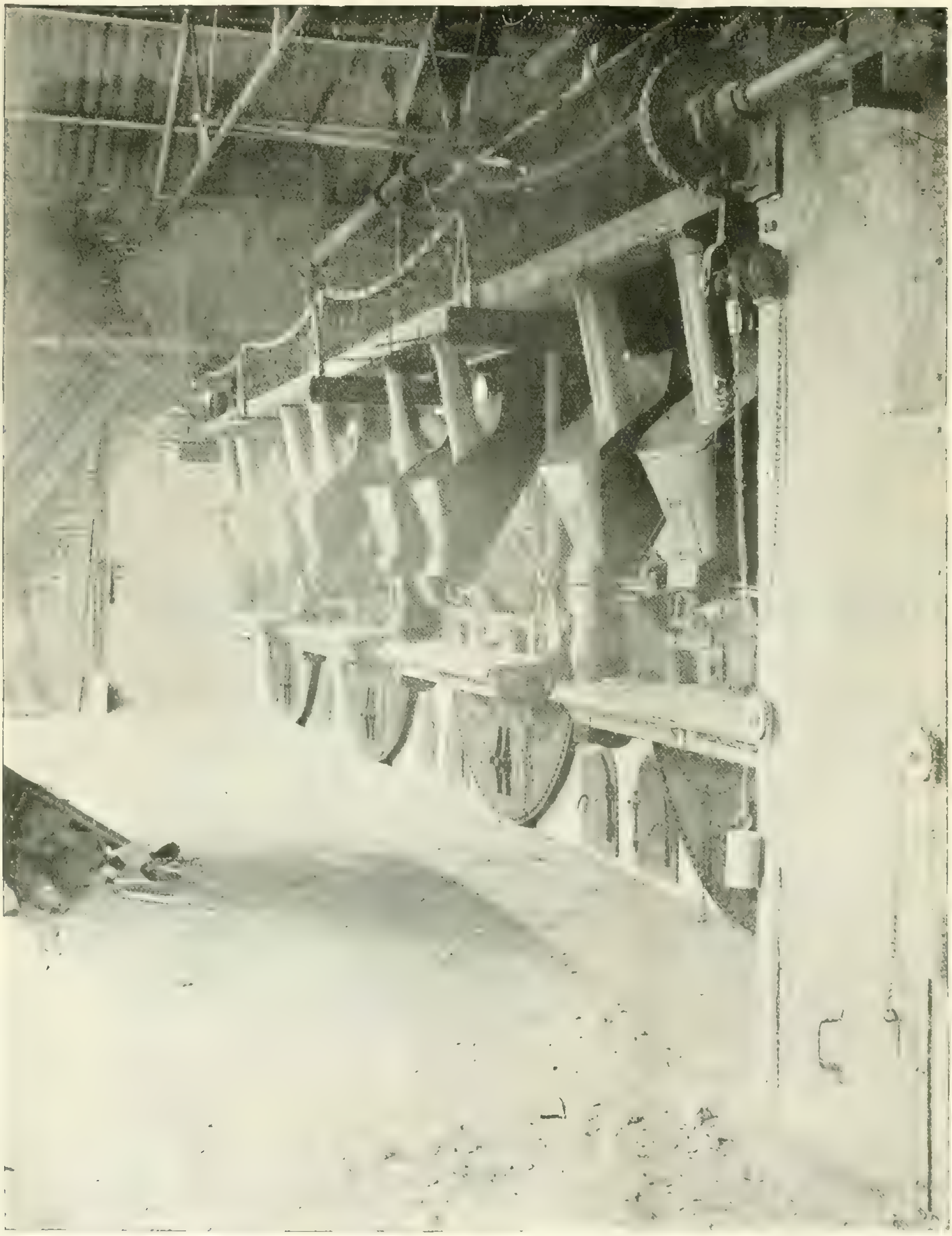

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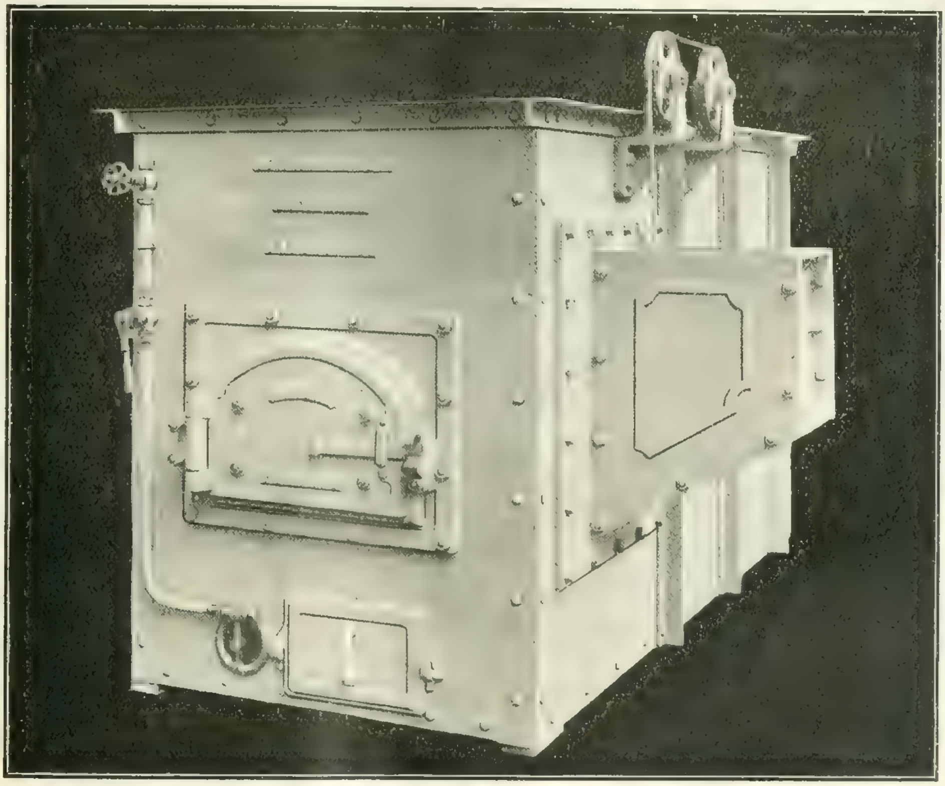

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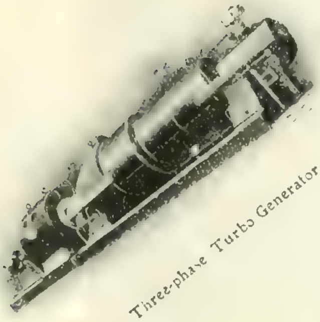

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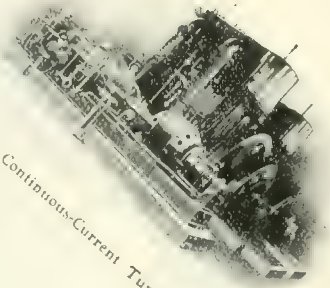

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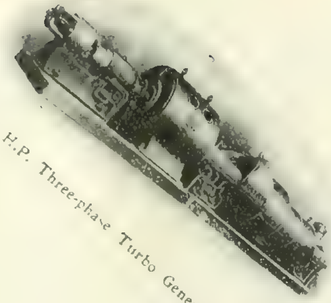

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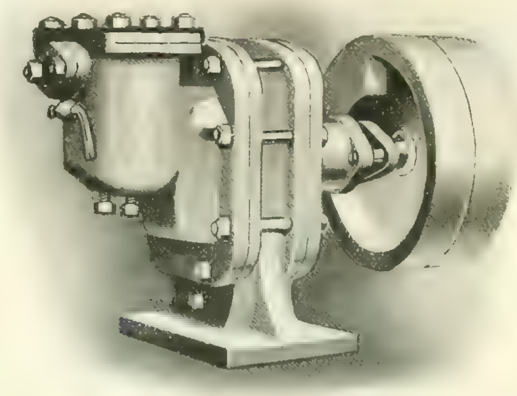

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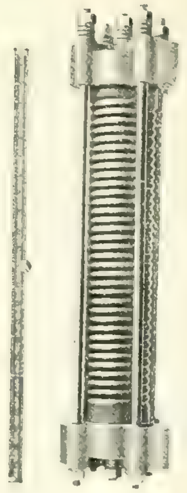

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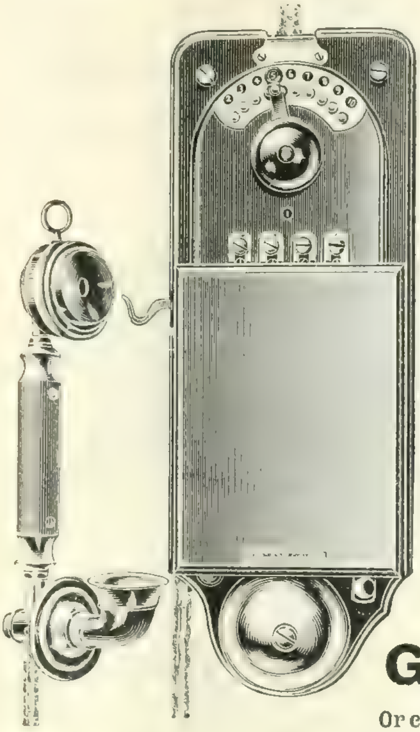

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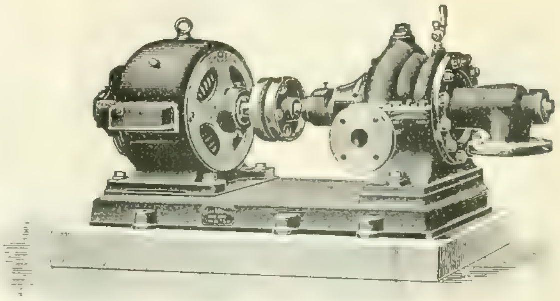

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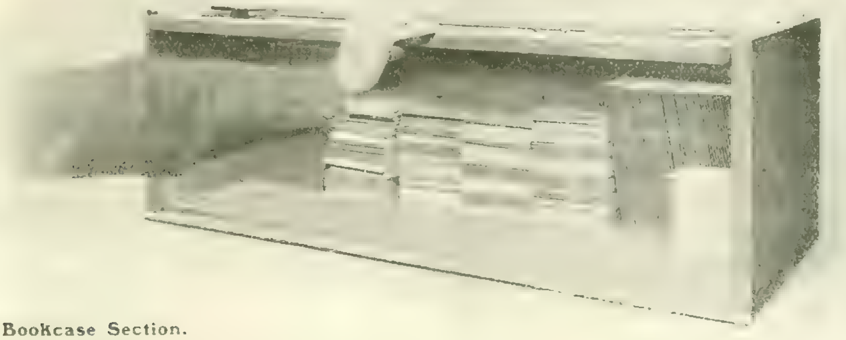

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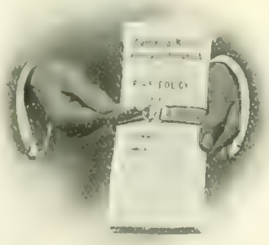

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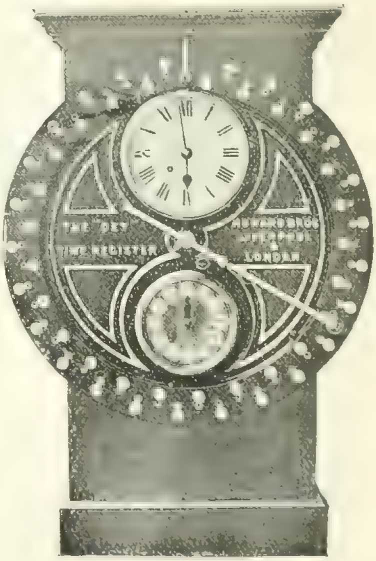

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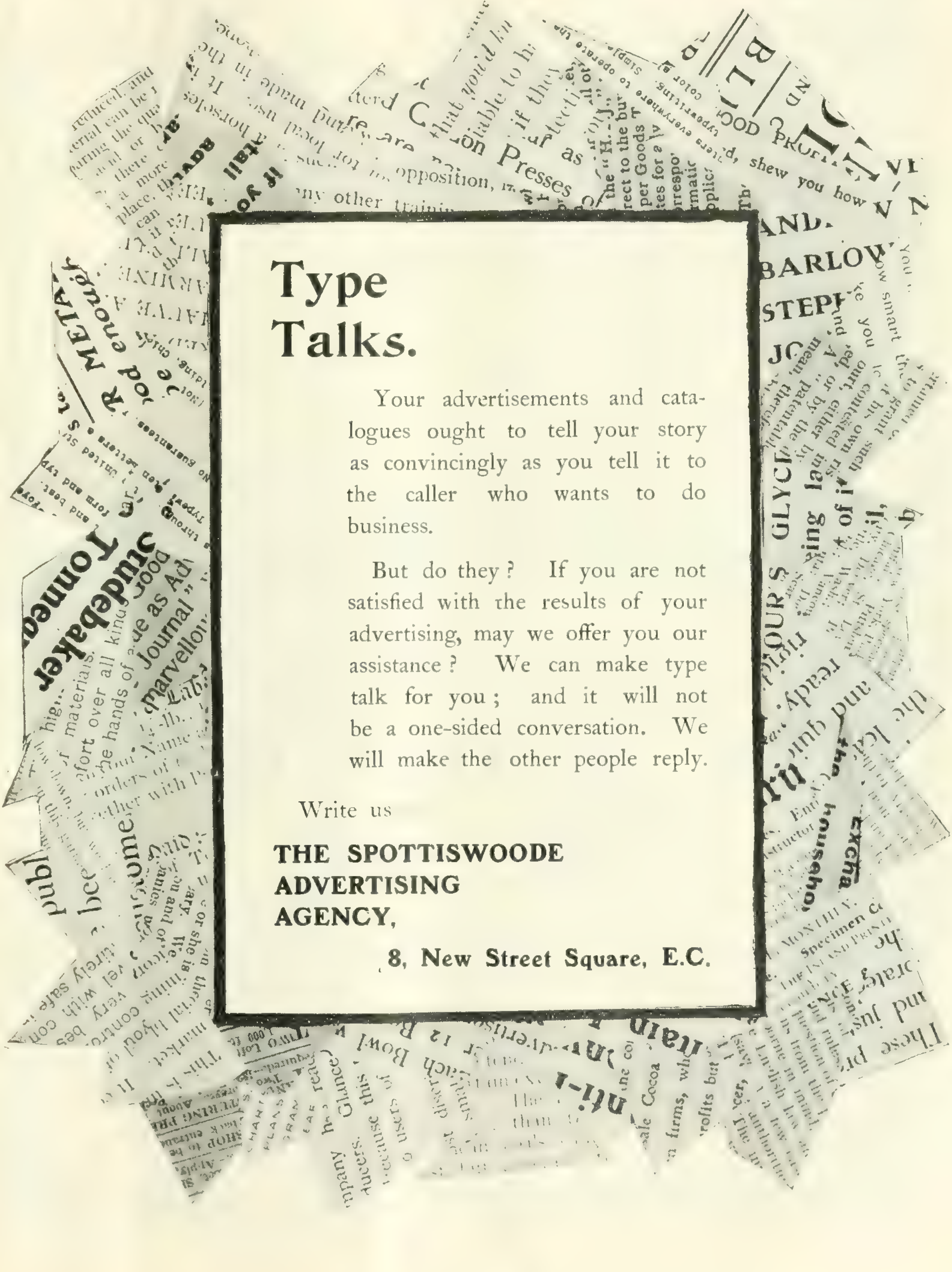

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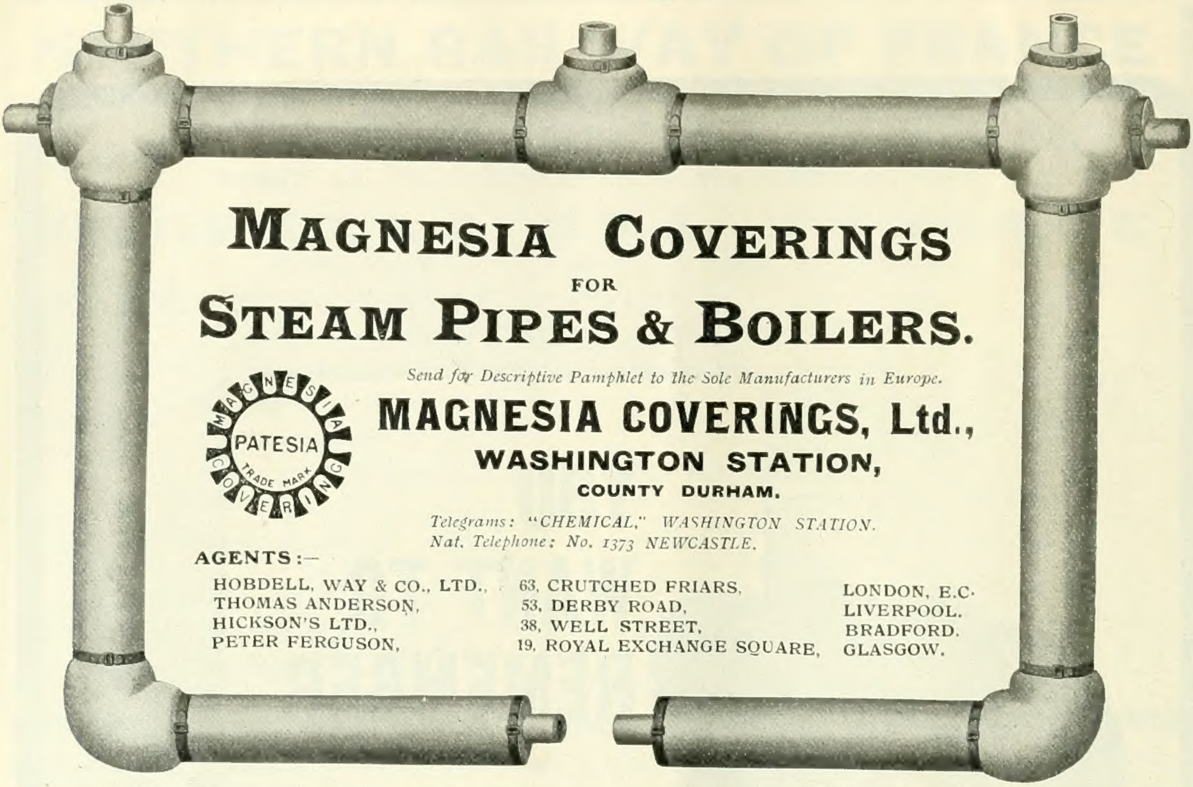

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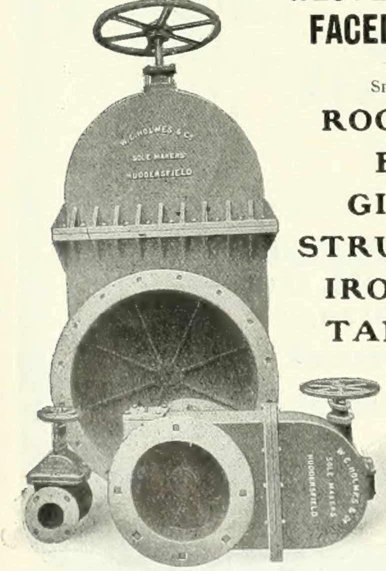

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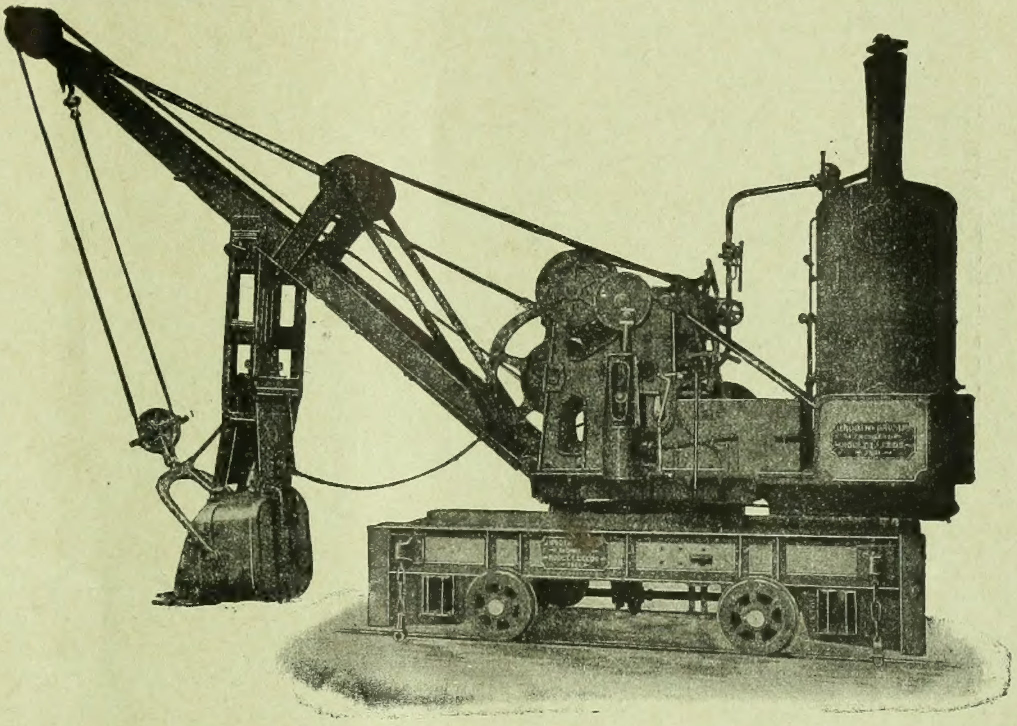

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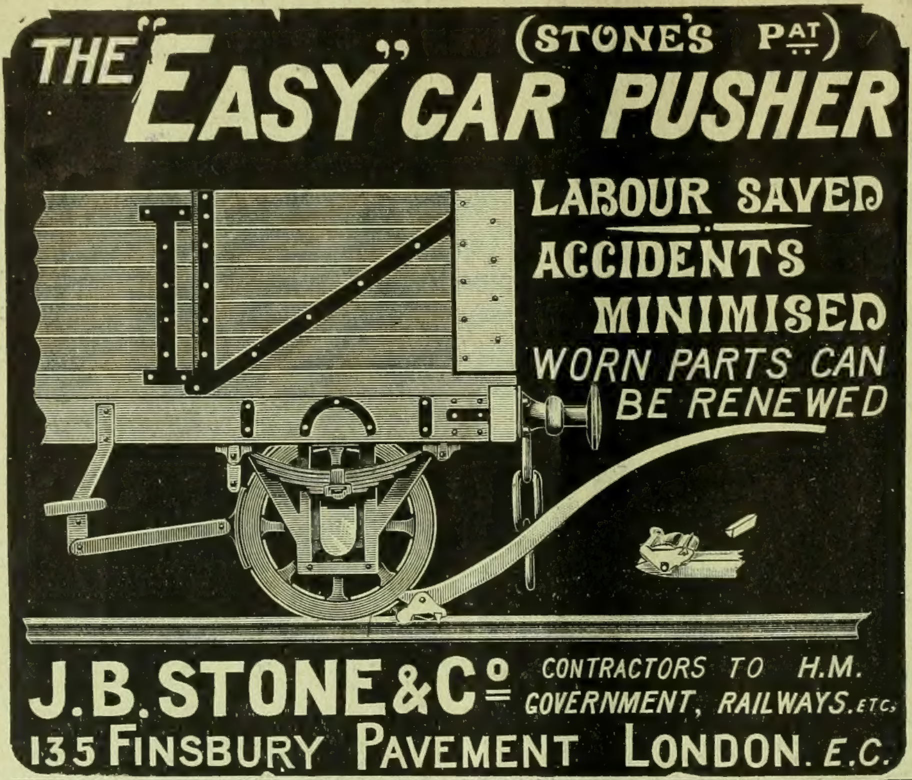

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